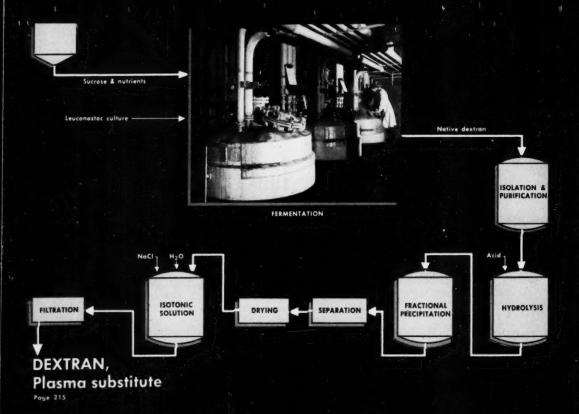
# SEPTEMBER 1952 ONE MUCOU ONG WEEVING





### Streamline your purchase of welding fittings



Write Dept. H-9 for free booklet listing properties of pipe and welding fitting and flange materials.



JUST AS THE USE of welding fittings streamlines a piping system so does the standardizing on TUBE-TURN Welding Fittings streamline your purchasing operations.

The TUBE-TURN Welding Reducer, both in the concentric type shown here and the eccentric type, is available in a complete range of sizes, wall thicknesses and types of materials. This is another example of how the complete TUBE TURNS' line is designed to meet all your requirements. It covers over 4000 different items. Thus you can simplify ordering and deliveries for any piping job by obtaining all your welding fittings and flanges from one reliable source . . . your TUBE TURNS' Distributor. You'll find one in every principal city.

Be sure you see the double "tt

### TUBE TURNS, INC. LOUISVILLE 1,

DISTRICT OFFICES: New York - Philadelphia - Pittsburgh - Chicago - Houston - Tulsa - San Francisco - Los Angeles
TUBE TURNS OF CANADA LIMITED, CHATHAM, ONTARIO ... A wholly owned subsidiary of TUBE TURNS, INC.



		ENGINEERING BC and ARP	Vol. 59	io. 1
Quotes, Extracts and Digests	359	Keeping Up	nd PamphletsInside Back C	
		URE AIDS	1.0 11.	200
Readers' Views and Comments	296	Industrial Notes	••••••••	302
Incentive Management at Work	119	Names in the N	ews	302
		ND FIRMS		
Chemical Engineering News	215	New Construction	m	36
Chemical Labor Output Goes Up	142	Convention Cale Process Industry	endar	36
CI - '- I V I - O I - I C - I I			01 1 1 7 1	36
Alberta's Oil Discoveries Will Feed a Growing Cl Market Research and Market Development	nemical I	ndustry		12
Why Celebrate Centennials?	homical I		Editorial Foreword	12
NEW	S AN	D TRENDS		
Froduct News			. 198	
Dextran Pinch Hits for Plasma				21
Ceramic Fiber Resists 2,300 deg. F			Pictured Flowsheet	19 20
Petrochemical Processes			Gordon Kiddoo, Feature Report	14
PROCES	SES A	ND PRODUC	TS	
Conosion Forum			. 270	
Plant Notebook Corrosion Forum	172	Equipment Nev	276	17
Corrosion Inhibitor Checklist			Maxey Brooke	28
What's Doing in Turbo Dryers			M. J. Berson	16
More Data on Heat Transfer to Fluidized Solid	s	W. E. Schmid,	E. P. Bartkus and T. E. Corrigan	14
Infrared Analyzers for Processes			Living H. Cooper	13
Use Statistical Averages for More Precise Materi How to Tailor Exchanger Area to Fit Batch Coo	oling Tim	e		12
		AND EQUIP		12
LDHORIA		NTA. J. O'Brien, Jr. Margaret Redfield	G. S. Bryant, Jr., John	Ke
SENIOR ASSOCIATE EDITOR I. K. Olive EDITORIA	L ASSISTA	NT Frances Arne	MIDWEST EDITORFrank C. I.	
Managing Epitok Lester B. Tope		Richard V. Reeves Joseph A. O'Connor	WEST COAST EDITOR Elliot S	
EDITORJohn R. Callaham Assistan	T EDITOR.	Calvin S. Cronan	SOUTHWEST EDITOR James	A. I
PUBLISHER	idly	EDITORIAL DI	RECTOR Sidney D. Kirkpatrick	

Member ABC and ABP

Member ABC and ABP

Published monthly by McGraw-Hill Publishing Company, Inc., James H. McGraw (1860-1948), Founder. Publication Office 99-129 North Broadway, Albany 1, N. Y.

19-129 North Broadway, Albany

### **AUTOMATIC CONTROL**

ENGINEERED DESIGN BY,

EQUIPMENT

HAMMEL-DAHL





One, of several hundred, Hammel-Dahl Balanced "Holo" Plug Angle Valves in the Middle East, controlling level in Oil Separators.



### HAMMEL-DAHL

Control Valves are serving...

Refineries, Chemical Process Industries and Pipe Lines

Write for your copies of our new illustrated Bulletins Nos. 101, 104 and 104-A.

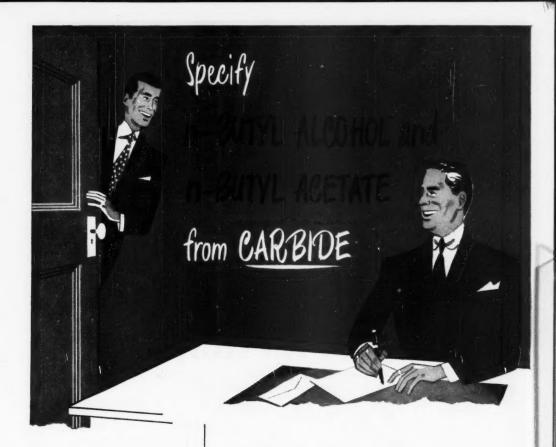
### HAMMEL-DAHL COMPANY

175 POST ROAD, IWARWICK PROVIDENCE 5, R. I., U. S. A.

Albany Boston Buffalo Chicago Cincinnati Cleveland Denver Detroit Houston Kalamazoo Kansas City Kingsport, Tenn. Los Angeles New Orleans New York Pittsburgh Salt Lake City San Francisco Seattle Springfield, Mass. St. Louis Syracuse Toledo Tulsa Wilmington, Del.

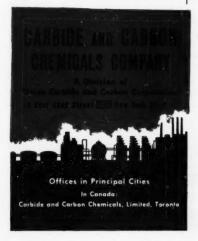
MANUFACTURED AND DISTRIBUTED BY Canada - The Guelph Engineering Co., Ltd., Guelph, Ontario

England - J Blakeborough & Sans, Ltd. Brighouse, Yorks. \* France - Premafrance, Paris



### YOU PROFIT BY

### Uniform purity... Fast delivery...



HIGH PURITY STANDARDS . . . CARBIDE'S Butyl Alcohol and Butyl Acetate are synthetic products. This means that they consistently meet high specifications . . . assure you uniform solvent performance in every formulation.

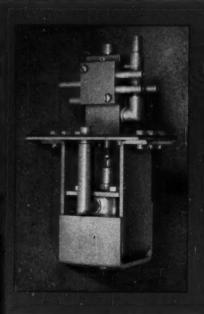
BASIC SOLVENT-COUPLER COMBINATION FOR QUALITY LACQUERS ... high dilution ratio... low viscosity solutions with good blush resistance and flow-out... excellent resin solvency.

FAST DELIVERY... because CARBIDE'S Butyl Alcohol and Butyl Acetate are now stocked in 48 warehouses throughout the U. S. Office-to-plant teletype places rush orders in minutes. For prices and delivery information, get in touch with the nearest CARBIDE office.



**OTHER "CARBIDE" SOLVENTS...** there are over 80 other solvents, couplers, and plasticizers that you can order from CARBIDE... a wide range of alcohols, esters, ketones, and glycol-ethers.

For a complete listing of Carbide themicals and their properties, send for "Physical Properties of Synthetic Organic Chemicals" (ask for F-6136).





Annual in special order for a determine, the amount's province for an authorized province for any action, thinks, below, and confirm of unbroadly faith any off including the bright yet analyses of the bright yet analyses of the second paint.

T Duct assumption shows here are trush from the vertiling later. Columns (200 about stack can be out, formed, hither and winded to make any type of delp with you apolity.

#### CHEMICAL AND ACID RESISTANT

INERT

Boltaron Boltaron

NON-TOXIC

RIGID, NON-PLASTICIZED POLYVINYL-CHLORIDE

#### CAN BE FABRICATED TO YOUR SPECIFICATIONS

AVAILABILITY — Distribution is limited to selected fabricators trained by the Hartwell Company. This ensures that your fabricator will make efficient and economical use of Boltaron 6200. Trained fabricators have already been licensed and established on West Coast, East Coast and in Central States area. All inquiries are processed by the Hartwell Company to ensure that the right fabricator is assigned to a given job. For further details, write to our home office, address below.

Machinability — Boltaron 6200 is unquestionably the best machinable plastic on the market today. Can be machined to any tolerance within the range of common metals. Will take any type of finish.

Wolds easier than steel — easily fused with low temperature hot lair torch.

Extrusions available — solid bar stock, 10' lengths, ¼" to 1" in diameter. Pipe in standard iron pipe sizes ½" to 2" i. d., 10' and 120' lengths... can be threaded with ordinary pipe dies.

Sheet stock — in sizes approximately 30" x 60" — 1/2" to 1" thick. | BOLTA, Lawrence, Mass.

#### **PARTIAL LIST OF USES**

Electroplating
Anodizing
Dyeing & Bleaching
Tanning
Brewing
Food Processing
Dairy Products Processing
Textile Processing
Photographic Processing
Industrial Plumbing

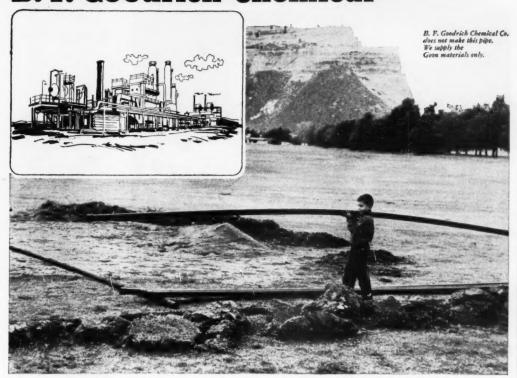
Boltaron 6200 is manufactured by

H. N. HARTWELL & SON, INC.

Industrial Plastics Division . Park Square Building, Boston 16, Mass.

Another new development using

### B. F. Goodrich Chemical raw materials



### From a golf course-plastic pipe idea!

CORROSION-PROOF...RESISTS CHEMICALS...LIGHT WEIGHT

THIS rigid polyvinyl plastic pipe carried by the boy will serve for years in an underground irrigation system for a golf course. And—it's a pipe with many possible uses in chemical processing and other applications.

The manufacturer found every quality he needed in Geon polyvinyl chloride resin for this plastic pipe. It resists soil acids or alkalies and electrolysis—vital for sub-surface installations. It needs no protective coating or wrapping. All adding up to reduced maintenance costs.

There are more Geon advantages and economies. Polyvinyl plastic pipe like this can be made rigid or flexible, useful for underground or overhead piping to carry gases or liquids.

It can be made light enough for a youngster to lift a length easily. Polyvinyl plastic pipe is four to six times lighter than steel pipe of equal length, diameter and wall thickness. Savings for you in freight and shipping costs, in handling, racking and stringing costs.

This plastic pipe is another example of how Geon materials help improve products and lower costs. For Geon materials can be made resistant to heat and cold, weather, aging, abrasion and most chemicals. Color range is wide. And they come as resins, latices or compounded plastics—can

be extruded, molded, coated, cast or dipped. For helpful technical advice, please write Dept. GF-5, B. F. Goodrich Chemical Company, Rose Building, Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ontario.



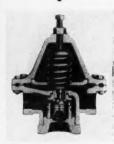
GEON RESINS • GOOD-RITE PLASTICIZERS . . . the ideal team to make products easier, better and more saleable.

GEON polyvinyl materials . HYCAR American rubber . GOOD-RITE chemicals and plasticizers . HARMON organic colors

### THIS FLOW PATTERN



BULLETINS
AVAILABLE
ON OTHER
CASH STANDARD
VALVES
Send for them



Bulletin 950—features the CASM STANDARD Type D Single Seel Pressure Reducing and Regularing Valves for use with most fluids. Shews simple inner working ports that save in maintenance. Diagram explains how valve works. Blueprint shows simplicity of installation.



Bulletin 936—features the CASH STANDARD Type 4030 Back Pressure Valve — designed to automatically maintain a constant pressure in the evaporator corresponding to a contant temperature desired. Shows an Ammonia and Freen Gas Capacity Chart based on ARSQUIET oressures.



Bulletin 966—features the CASH STANDARD Self-Contained, Pilot Operated Type 10 Pressure Reducing and Regulating Valve for use with water or air; with any gas or eil that is non-corrosive; and with refrigerating fluids such as Ammonia and Freon. Many interesting particulars explained such as: how valve works, tight seoting, large capacity, no waste, no water hommer or chalter.

#### Benefits

Maximum Capacity when needed most Accurate Pressure Control under toughest working conditions. Trouble-free Service Smooth Operation Tight Closure Accurate Regulation Speedier Production Results Eluits Constant Delivery

Pressure
Cost Saving Operation
No Spoilage
Practically zero in maintenance costs

With these three features—all in one valve, you are getting Valve performance that gives you cost saving benefits that begin with the installation and last for years.

First, the streamlined flow around the inner valve; then the straight path for the fluid through the flow tube; then the aspirator which turns small pressure changes into large valve operating forces. These things have made the Streamliner click.

Bulletin 962 features the CASH STANDARD Streamlined Type 1000 Pressure Reducing Valve—illustrates the streamlined construction and tells why you get exceptionally long, trouble-free, low-cost performance. Points out why you get no turbulence and therefore can meet peak demand at all times. Explains why straightline flow gives you maximum capacity, close delivery pressure control, and tight closure.

CASH STANDARD
CONTROLS...
VALVES

A. W. CASH COMPANY DECATUR, ILLINOIS

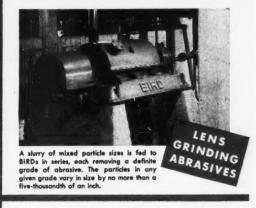
### TAKE A TIP FROM THESE BIRDS



LIME Pulp and paper mills employing the lime soda process are putting BIRDs ahead of their lime recovery kilns to dewater the lime mud before re-burning. They're getting MUD uniform dryness, better kiln operation and a saving of 20 to 25 gallons of fuel oil per ton of time pro-

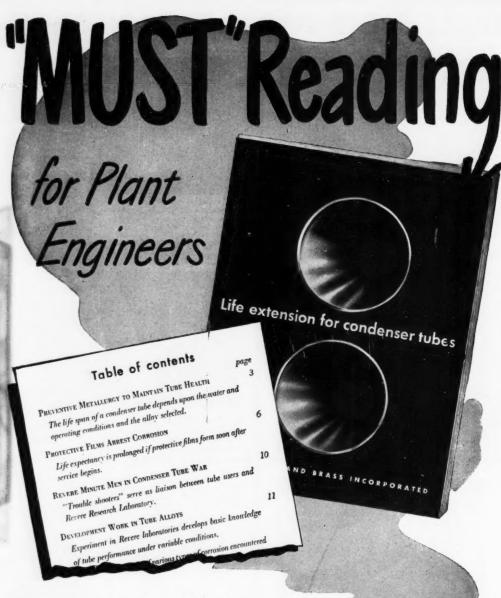












• We doubt very much if you have ever read a booklet on Condenser Tubes, quite like this one.

Plant engineers should find it of unusual interest particularly with present restrictions on copper and its alloys making it more important than ever that every last ounce of use be squeezed out of the condenser tubes in their plants.

This 28-page booklet includes data on various copper alloys, photos of cut-away tube sections showing various types of corrosion encountered in condenser tube service and photomicrographs showing the grain structure of different kinds of metals under varying operating conditions.

Send for your copy today. Please make request on your firm's letterhead. Thank you. Address Department P.R., Revere Copper and Brass Incorporated, 230 Park Avenue, N. Y. 17, N. Y.

### REVERE COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801 230 Park Avenue, New York 17, N. Y.

Mills: Bultimore, Md.: Chicago and Clinton, Ill.: Detroit. Mich.:
Los Angeles and Riverside, Calif.: New Bedford, Mass.; Rome, N. Y.—
Sales Offices in Principal Clites, Distributors Everywhere
SEE REVERS: "MEET THE PRESS" ON MEC TELEVISION EVERY SUNDAY

### Why LINK-BELT "total engineering" means better screw conveyors for you...

#### LINK-BELT integrates all components to give you the right screw conveyor for your job

Don't be fooled by the apparent simplicity of a screw conveyor. It is simple in design, but there are many important factors that must be considered to give you top performance.

That's why Link-Belt's broad materials handling experience is so important . . . why Link-Belt Screw Conveyors are first choice on so many demanding jobs. And because Link-Belt makes all types and sizes of components, you get exactly the right screw conveyor for your particular requirements.

It's easy to see why "total engineering" results in top screw conveyor performance. Call the Link-Belt office near you for complete information.

Four Link-Belt Helicoid Screw Conveyors distribute material from Link-Belt Bucket Elevator discharge.



SCREWS-Link-Belt makes a complete range of conveyor screws-Helicoid, Sectional Flight, Cut Flight, Ribbon Flight, Paddle type and special



types for such diverse applications as feeding, conveying, mixing, agitating, stirring, blending,





SPOUTS & GATES - Plain discharge spouts can be fixed or detachable. Discharge gates, flat or curved slide, can be hand or rack-

TROUGHS - Link-Belt builds flanged, angle flanged, flared, rec-

tangular, dust-seal, jacketed and

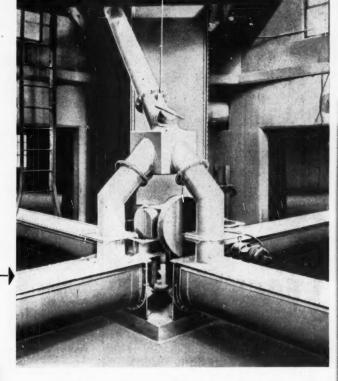
drop-bottom types in steel or alloy metals. Variety of connec-

tions, supports, covers and clamps offers added design flexibility.





SHAFTS & COUPLINGS - Conveyor couplings and end shafts are designed for adequate torsional strength and have jig-drilled coupling bolt holes for accurate align-





TROUGH ENDS-Steel or alloy metal plate or cast trough ends to match all trough shapes, provide required shaft bearing support and alignment. Seal glands to protect bearings, if required.



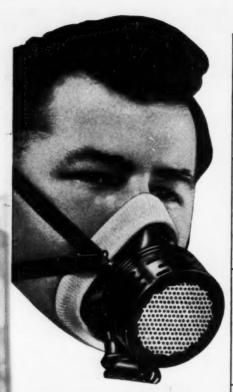
DRIVES: Link-Belt designs and builds many forms of drives to suit specific conditions-enclosed gear, Electrofluid, P.I.V. variable speed. and chain drives of various

Link-Belt can also supply a full range of flanges, thrusts, covers, saddles and countershaft ends



**SCREW CONVEYORS** 

LINK-BELT COMPANY: Chicago 9, Indianapolis 6, Philadelphia 40, Adlanta, Houston 1, Minneapolis 5, San Francisco 24, Los Angeles 33, Seattle 4, Toronto 8, Springs (South Africa). Offices in Principal Cities.



### 1 FACE PIECE — 7 CARTRIDGES

(Quickly Interchangeable)



•WITH #31 CARTRIDGE — For low concentration of light organic vapors and gases in paint spraying, degressing, dry cleaning, cementing, etc. Absorbs vapors of bennes, price, toluene, gasoline, naphtha, acotione, turnentine, etc.





•WITH \$32 CARTRIDGE — For low concentrations of acid gaseq, mists — sulphuric acid, hydrogen chloride, etc. Used in plating, pickling operations and similar.



•WITH R15 CARTRIDGE — For nuisance and pneumoconiosis-producing dusts. (BM-2121)



\*WITH 833 CARTRIDGE — For low concentrations of combined acid and organic gases such as halogenated hydrocarbons, carbon tetrachloride, acetic scid. Protects in degreasing operations, etc.



\*WITH R16 CARTRIDGE — For toxic dusts not significantly more harmful than lead. (BM-2136)



•WITH #34 CARTRIDGE—Protects against nuisance concentrations of ammonis.



\*WITH R17 CARTRIDGE...For all dusts not significantly more toxic than lead. (BM-2138)

### Protect against Dusts, Gases and Vapors

### WITH THE AO R2000 RESPIRATOR

When a variety of hazardous vapors, gases or dusts are a problem, you can now simplify the protection and save money by standardizing on the AO R2000 Respirator. Its single, basic face piece accommodates four chemical cartridges of NON-SPARKING metal and three dust cartridges which, while light in weight for comfort, have maximum filtering capacity. CARTRIDGES INTER-CHANGE WITH A TWIST OF THE WRIST—one twist removes outer cover, a second replaces it. Respirator may also be used with highly efficient, chemically-treated disposable dust filter.

Your nearest AO Safety Products Representative can supply you American O Optical

#### QUICK RESPIRATOR FACTS

- Face mask molded from pliable rubber.
- ½" rubber headband.
- Inhalation valve of pure gum rubber freely admits air at lightest intake of breath, seals tightly on exhalation.
- Exhalation valve cannot stick, completely expels air—moisture cannot collect, dust cannot enter.
  - Disassembly for cleaning is easy without special tools.

SOUTHBRIDGE, MASSACHUSETTS . BRANCHES IN PRINCIPAL CITIES

### Only B. F. Goodrich makes the grommet belts that cut costs 20 to 50%!

### Save 3 ways! Investigate today! Write or mail coupon

You save belt costs because belts last longer, save production costs because machines keep running with fewer interruptions, save maintenance costs because they need less attention.

Patented grommet belts by B. F. Goodrich represent the only basic change since invention of the V best. Belts last 20 to 50 per cent longer, depending on service. (The more severe the service, the greater the increase over ordinary belts.) Grommet belts have more rubber; they're more flexible, give better grip, less slip.

#### What is a grommet?

A grommet is like a giant cable except that it's endless—a cord loop built up by winding heavy cord on itself. There is no overlapping cord section as in all ordinary belts. Most belt failures occur in these sections where cords overlap!

#### All cords put to work

Each of the two grommets and every part of a grommet carry their share of the load. In ordinary belts under high tension the center cords "dish" because tension is greater near the driving faces. Dished cords are doing less work, not pulling their share. Grommet belts have no center cords, there is no dishing—therefore much more strength in proportion to cord volume—and less stretch. Grommet belts stretch, on an average, only about one-third as much as ordinary belts.

#### Better grip, less slip

Grommet belts have more rubber in relation to belt size. Without any stiff overlap, they're more flexible, grip pulleys better. Size for size, grommet belts give ½ more gripping power, pull heavier loads with a higher safety factor. Because there is less slip, there is also less surface wear.

#### Send for proof

Send the coupon for a set of reports telling users' experiences and showing actual installations where grommet belts outlasted all others. Some typical cases: "... within a few days ordinary belts had stretched ... After six months of 24-hour-aday service BFG grommet belts haven't stretched at all ..."

"Ordinary belts lasted only 5 or 6 weeks . . . B. F. Goodrich grommet belts are in their sixth month of service . . ."

"Previous belts suffered from shock loads, wore out fast . . . BFG grommet belts have been in service 2 years with no shut-downs ..."

There are hundreds of cases like these.

#### They cost no more

BFG grommet belts cost not one cent more than others. The savings they make for you are clear profit. They are made in C, D and E sections. They are patented by B. F. Goodrich. No other V belt is a grommet belt (U. S. Patent No. 2,233,294).

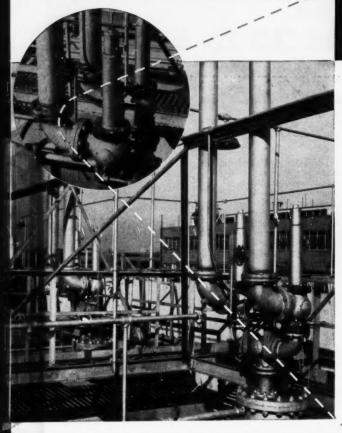
Write, send the coupon or see your B. F. Goodrich distributor. (He will show you his "X-ray" belt that shows the grommet construction clearly.)



provide and a record communication	and the second	and a distribution of the second seconds.
Gromm	Grom	met
	Rubber	
	Comment of the same of the sam	
3. F.	GOODRICH GROMMET V BELT	
9		

Dept.	. F. Goodrich Company CE-9 n, Ohio
pe	nd set of reports telling users' ex- riences and showing actual installa- ins proving that B. F. Goodrich ommet belts outlast all others.
be	we distributor show me the "X-ray" it that shows how B. F. Goodrich ommet belts are made.
Name	
Firm 1	Name
Street	Address
City	
State_	

Have your cake and eat it too! Have your cake and eat it too!
... or how GOOD YEAR
gets the benefits of the
Safety



# Head

"fail-safe" action . . . WITHOUT LOSS OF VALUABLE BUTADIENE

Safety and savings go in pairs at the Goodyear Tire and Rubber Company's Chemigum Plant at Akron, Ohio...made possible by use of BS&B Combination SAFETY HEAD – Relief Valve Models CL-31. When the designed rupture pressure of the 125 lbs. Monel or stainless rupture disc is reached it will "fail-safe", thus relieving the pressure and preventing damage to expensive equipment, and most important of all...personnel injury.

However, working with BS&B engineers and adapting standard equipment, Goodyear has carried safety a step fur-ther to include savings. Each of the 15,000 gallon butadiene storage tanks, operating at maximum average pressures of 75 psig. is equipped with a manually operated 3-way valve and two CL-31s. This dual SAFETY-HEAD-Relief Valve arrangement prevents the excessive and expensive loss of valuable butadiene in the event of a ruptured disc. Quick, easy switch-over to the second combination unit is possible giving full safety protection again - even while the replacement of a burst disc in the first combination unit is going on.

### **Built-in SAFETY for chemical processing**

BS&B SAFETY HEADS assure instant pressure relief when needed most. They can be used as both primary and secondary relief devices ... designed to rupture within plus or minus 5% of the pre-determined pressure. Discs are available within a range of 5 lbs. to 40,000 lbs. Regardless of your pressure application—air, gas or liquid—bland or corrosive,
BS&B has the code-accepted SAFETY HEAD FOR YOU. Write for catalog giving complete details.

Get the facts and you'll want the built-in safety
BS&B SAFETY HEADS provide.





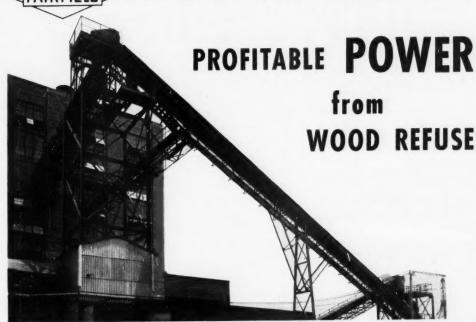
BLACK, SIVALLS & BRYSON, INC.

Dept. 2-N9

7500 East 12th Street

Kansas City 3, Missouri





### with FAIRFIELD handling systems

Economical power from wood waste has become a reality for many wood products industries who have worked with Fairfield Engineering to develop proper wood refuse handling systems to feed boilers.

Illustrated here are scenes of such an installation profitably at work for a large southern Kraft pulp and paper mill. The Fairfield system consists of a series of belt conveyors which transport bark from the debarking mill, through bark hogs and up to the top of the boiler house where it is stored in a Fairfield "live-bottom" bin. The bottom of the bin contains a series of screw conveyors which properly feed the bark to stokers directly below the bin. Plant officials say that the performance of this Fairfield system has been very satisfactory and has lived up to all expectations.

Investigate this potential power from your wood waste now—an engineering treatise on wood waste systems and a copy of Bulletin 352 is available, write us today.



One of the many enclosed Fairfield Belt Conveyors discharging bark into the "live-bottom" bin atop the bailer house.



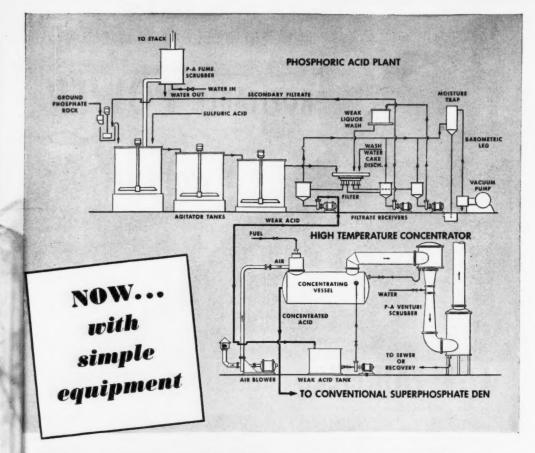
The FAIRFIELD ENGINEERING COMPANY

Chicago Avenue

MARION, OHIO



Screw conveyors built into bottom of the Fairfield "live-bottom" bin feed the bark into the stakers.



### High Strength Phosphate Fertilizers

A series of tests and demonstration runs at Hattiesburg, Mississippi, has shown that enriched and triple superphosphate fertilizers can be produced on a commercial basis in conventional single superphosphate dens. This is accomplished by substituting phosphoric acid for sulfuric acid in the manufacturing process.

The diagrams above illustrate successful Chemico methods for (1) the production of phosphoric acid by the wet process; (2) the concentration of the phosphoric acid in a Chemico high temperature concentrator. By adding these facilities to your plant, enriched superphosphates (26 to 28% A.P.A.) or triple superphosphates (up to 47% A.P.A.) can readily be produced. Chemico also offers complete triple superphosphate plants.

For further information, write us giving details on your specific problem.

#### CHEMICAL CONSTRUCTION CORPORATION

A UNIT OF AMERICAN CYANAMID COMPANY

488 MADISON AVENUE, NEW YORK 22, N. Y.

CABLES: CHEMICONST, NEW YORK

TECHNICAL REPRESENTATIVES: CYANAMID PRODUCTS LTD., LONDON • CHEMICAL CONSTRUCTION (INTER-AMERICAN) LTD., TORONTO • SOUTH AFRICAN CYANAMID (FTY) LTD., JOHANNESBURG



Chemico plants are profitable investments

### 5 YEARS' SERVICE

### Without a Shutdown!

CHAIN drive used formerly on this heavy-duty mill drive was a constant source of trouble, with link-pin breakages causing frequent shutdowns—plus extreme noise and dirt condition—on this drive.

The G.T.M.—Goodyear Technical Man—installed Steel Cable V-Belt Drive in January 1947. This drive hasn't been touched for any reason since, except one belt take-up after about a year.

GOODYEAR INDUSTRIAL RUBBER PRODUCTS

-Specified

STEEL CABLE V-BELL DRIVE



GOODFYEAR

THE GREATEST NAME IN RUBBER

highest standard of quality.

HNO<sub>3</sub>

H2SO4

HO,HN

HCI

HEAVY STEEL PLATE BONDERIZED SURFACE

FORMALDEHYDE-ALHYD-TYPE ENAMEL

THERMOSET VARNISH\_

THERMOSET VARNISH\_

FINAL COAT OF GRAY LACQUER.

### FIVE Plus BANDS OF PROTECTION

### make this the longest-lived chemical motor

You get more protection against corrosive materials with the Westinghouse Life-Line chemical motor than with any other. Take this example:

An Eastern Fuel and Gas Company has a cyanide pump that pumps thyocyanate. At times the pump leaks, throwing thyocyanate over the motor. Conventional motors rotted out at the feet in about six months. A Life-Line installed on this same pump for over a year brought this statement from the foreman of electrical maintenance:

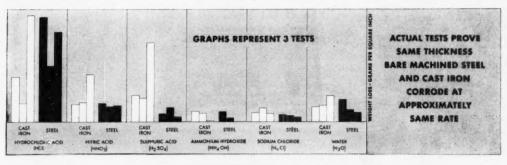
"This is the first motor we did not have to drill out the bolts and screws to take the motor apart. A closer inspection of the motor showed the end brackets and frame in excellent shape; the fan, windings and rotor looked as good as the day they left the motor plant." Consider the five plus bands of protection. You'll understand this extra life. The frame, feet, and brackets are steel. (Note: Steel and cast iron of same thickness bave approximately equal corrosion resistance. See graph below.)

This steel is first Bonderized then a formaldehyde alkyd-type enamel, well known for its superior corrosion resistance, is baked on. Two dips and bakes of tough, flexible Thermoset varnish follow. Finally, the motor is sprayed with a finish coat of gray lacquer. Five bands for longest life!

#### DO YOU NEED SOMETHING EXTRA IN A MOTOR?

Extra protection against corrosion—or outage from any cause? Check Life-Line—they cost no more. Ask your Westinghouse representative for a copy of Chemical Motor Booklet B-4687, or write Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pennsylvania.

J-21637





### American Blower...a time-honored name in air handling



Columbus, Ohio, has a conveniently located American Blower Branch Office to provide you with data and equipment for air handling. You can reach American Blower in Columbus by calling University 9190. In other cities, consult your phone book.



#### MORE BUSHELS

Recently, a manufacturer bought several of our type TM Gyrol Fluid Drive units for use on his oil seed presses. Then, he kept close records on the performance of each press for almost a year. Reports show that with the Gyrol Fluid Drives, the daily capacity of each press was boosted from 1300 to 1650 bushels! For the advantages of smooth power transmission, shock absorption and overload protection on your machines, call your nearest American Blower Branch Office.



#### BETTER PROCESSING

Why not call on American Blower to help with the air handling assignments in your chemical process work? We've had plenty of firsthand experience. Major chemical producers use American Blower fans and blowers (both standard and special types) in processing chlorine, elemental phosphorus, sulphuric acid, bleach and caustic. Our branch office personnel can often save you time with on-the-spot suggestions.



#### NOW IS THE TIME ...

Plan now for winter heating. If your present heating system is inadequate or inefficient, replace or supplement it with American Blower Unit Heaters. These efficient Unit Heaters distribute heat evenly over a wide area, assure comfortable final temperatures everywhere. In many installations, American Blower Unit Heaters have paid for themselves in fuel savings alone within two to three years! Models for steam or hot water heating systems, also self-contained, gas-fired models.

Whether your needs are civilian or military, American Blower heating, cooling, drying, air conditioning and air handling equipment contributes toward improving over-all comfort and efficiency. For data, phone or write our nearest branch office.

AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO

Division of AMERICAN RADIATOR & Standard Sanitary corporation



**Unit Heaters** 



Mechanical Draft Fans



**Dust Collectors** 



Gýrol Fluid Drives



**Industrial Fans** 

YOUR BEST

**AMERICAN** 



BLOWER

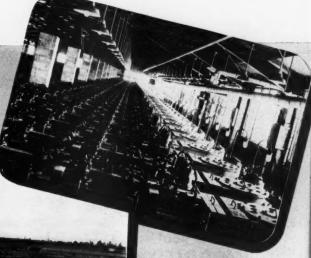
AIR HANDLING

Serving bome and industry: AMERICAN STANDARD . AMERICAN BLOWER . CHURCH SEATS . BETROIT LUBRICATOR . REVANCE BOILERS . BOSS HEATER . TORNWANDA IRON



View of Mathieson Mercury Cell Installation now in operation.

il a things was inthis



General view of chlorine and caustic soda plant now under construction.

View of rectifier building and cell building now under construction.

This new chlorine and caustic soda installation is further evidence that the Mathieson Mercury Cell Process as engineered and constructed by Blaw-Knox has many advantageous features... Large capacity cells... High purity chlorine and rayon-grade caustic soda directly from the cells... Guaranteed performance. High efficiency, low cost... Simplified

process design... Well-engineered plant layouts to fit individual needs ... Complete "turnkey" plants of this Mathieson development—The result of over 50 years' experience in mercury cell operation.

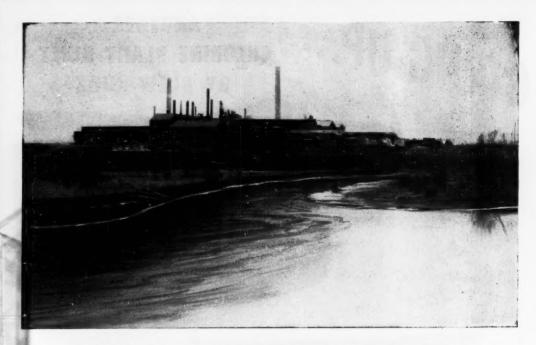
If interested in the latest method of producing low-cost, high-purity chlorine and caustic soda, send today for *Bulletin 2261*.

### BLAW-KNOX

930 Duquesne Way, Pittsburgh 22, Pa.

930 Duquesne Way, Pittsburgh 22, Pa.
Tulsa 1 • New York 17 • Philadelphia 3 • Chicage 1 • Birmingham 3 •
Washington 5, D. C. • San Francisco 5

CHEMICAL PLANTS
DIVISION



### **WORRIED ABOUT WASTE DISPOSAL?**

### **Bailey Meters Help you to Reduce Pollution**

 The disposal of industrial wastes without stream pollution calls for careful planning and continuous vigilance.

That's where Bailey Meters and Controls come in. We measure the flow and pH of sewage, sludge, and industrial wastes flowing in open channels or pipe lines. These and other factors, such as levels, rates of chemical feed, and flow of air, may be co-ordinated into a completely automatic system for the treatment and disposal of waste materials.

When you want fast, complete and authoritative answers to the measurement and control aspects of your waste disposal problems, reach for your phone and call your local Bailey Engineer. Offices in all principal industrial centers.



#### BAILEY OPEN CHANNEL METERS

These indicating, recording and integrating meters are suitable for measuring industrial wastes, sewege, sludge, corrosive liquids, and irrigation water flowing in all types of open channel primary metering devices, such as Venturi flumes, weirs, or nozzle flumes. Electric or pneumatic telemetering permits location of receivers wherever desired. Ratio of flows and chemical feeds may be controlled automatically.

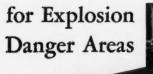
### BAILEY METER COMPANY

1054 IVANHOE ROAD CLEVELAND 10, OHIO

Process Controls TEMPERATURE - FLOW PRESSURE - LEVEL GAS ANALYSIS - RATIO

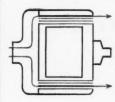
P-24

### Your Best Motor Buy





### **Practically Self-Cleaning**



Air-to-air heat exchanger has straight, smooth tubes with no pockets to collect dirt or moisture. Velocity of cooling air through tubes keeps surfaces swept clean. If sticky dirt piles up, tubes can be cleaned quickly with long handled brush.

#### Choice of Tube Materials

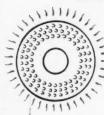


Antimonial Lead

tors can be built for service in corrosive atmospheres. Tubes may be made of a variety of materials. Motors will carry Underwriters' Label for Class I Group D or Class II Group F or Class II Group G.

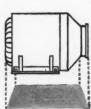
Allis-Chalmers tube-type mo-

### **Uniform Cooling**



Tubes for carrying cooling air are distributed uniformly around the perimeter of the stator and along its full length. Result: heat travels over a short path and the interior is uniformly cooled.

#### Compact



Allis-Chalmers tube-type motors are little or no larger than open motors of the same rating. Internal compartmentation divides motor into two chambers, keeping pressure at a lower level should an internal explosion occur.

Get Complete Information Now — Ask your Allis-Chalmers district office representative about tube-type explosion-proof motors in sizes up to 3000 hp with Underwriters' Labels to 800 hp at 3600 rpm. Or write Allis-Chalmers, Milwaukee 1, Wisconsin, and ask for Bulletin 51B7149.

IS-CHALME





### ANYONE CAN BUILD A PNEUMATIC CONVEYOR...

It's true! Anyone can build a pneumatic conveyor—of some sort. Of course, it won't be efficient . . . it won't streamline your materials handling operations . . . and it won't reduce your handling costs — but it will be a pneumatic conveyor.

However, in solving your bulk materials handling problems, you will want to investigate Dracco Airstream Conveyors. Each high-efficiency, automatic Airstream Conveying system is:

1. Designed for a cost-saving solution

to your specific handling problem.

- Designed accurately by engineers having many years of experience exclusively in this field.
- 3. Constructed of quality materials for long, trouble-free service.

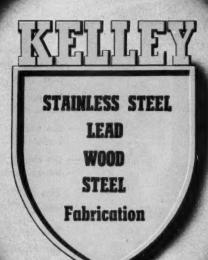
If you are handling bulk granular or powdered materials, remember that Dracco Airstream Conveyors possess unique advantages over any other type of system.

DRACCO CORPORATION Harvard Ave. and E. 116th St., Cleveland 5, Ohio





Airstream CONVEYORS · DUST CONTROL EQUIPMENT



### O.G. KELLEY & CO.

ENGINEERS

DESIGNERS FABRICATORS

96 TAYLOR STREET, BOSTON 22, MASS.

### It's better to get all your valves from ONE source

Mecouse when you do this you avoid the confusion that accompanies stocking spara parts for valves of several different makes.

the multiple stacking of valves and parts be-

the needless complications that confront your

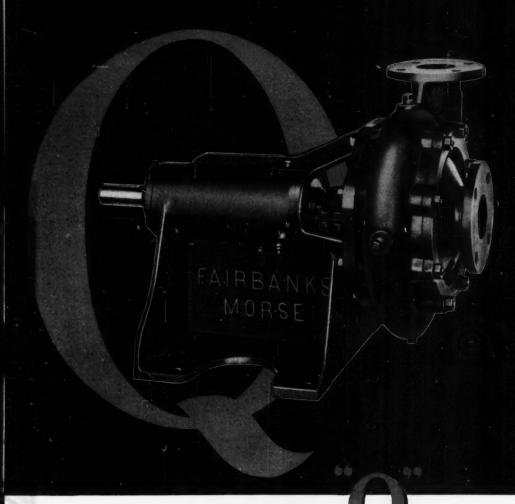
the chance that some valves are not backed by adequate manufacturer's engineering services.

The Powell Line is so complete that you can get all your valves from one source.

The Wm. Powell Co. Cincinnati 22, Ohio

POWELL





it's Your



Quality... that costs no more is yours when you choose Fairbanks-Morse Side Suction Centrifugal Pumps. Extensive engineering laboratories... production line methods with precision machining of all parts enable Fairbanks-Morse to offer you a side suction centrifugal with the design, workmanship and performance normally obtained only in highest quality split-case pumps.

Open type, single suction, high efficiency impeller

... ball-bearing frame construction for long life and smooth operation ... one-piece, solid cast frame ... close-grained smooth cast iron volute ... are among the many big pump features you'll find in these moderate priced side suction centrifugals.

For a "cue" to better pump performance, choose the pumps that spell quality with a capital "Q"... Fairbanks-Morse Side Suction Centrifugals. Fairbanks, Morse & Co., 600 S. Michigan, Chicago 5, Ill.



### FAIRBANKS-MORSE,

a name worth remembering when you want the best

PUMPS • DIESEL LOCOMOTIVES • ELECTRICAL MACHINERY • SCALES • HOME WATER SERVICE EQUIPMENT • RAIL CARS • FARM MACHINERY • MAGNETOS

#### PLATING

In copper and chromium plating of roto-gravure rolls, the temperature of plating solutions is held to within 14°F by Sarce Electric Indicating Temperature Controllers. Photo taken in Southern Gravure Service plant, Louisville, Ky.

#### CHEMICAL

Hoffman La Roche Pharmaceutical Co., Nutley, N. J .- the jacket water temperature of these stills must be held to within 1/2°F. For the past 9 years, Sarco LSI Indicating Temperature Controllers have been doing that job.

#### FOOD

Chocolate milk and soft drinks in bottles and cans are processed in Fort Wayne Sterilizers. Many users equip these Sterilizers with Sarco LSI Electric Indicating Controllers to hold the tempera-ture to within 1/2°F. Hook-up sketches and case histories on re-

#### TEXTILE

The Backus Hosiery Conditioner processes 15 denier nylon hosiery - 40 dozen per 1 hour cycle. The humidity and dry heat are controlled by two Sarco Electric Indicating Temperature Controllers. Over 500 LSI's have been factoryinstalled on these Conditioners by Backus Machine Works, Carlstadt, N. J.



### SARCO electric temperature control

#### ACCURACY AND SENSITIVITY BY SIMPLE ELECTRICAL MEANS

"Very successful in our operation, and I specify them on all our new equipment," says Thomas Allison, Plant Engineer of Southern Gravure Service, Louisville, Ky. (See photo at left)

IN HIS CASE the operation is plating, an industry in which SARCO electric controls have found wide adoption.

There are many others: For example, dryers in the textile, tanning, food and chemical industries; dyeing and wet finishing processes in textiles; processing, distilling and evaporating in chemical plants.

SARCO's complete line includes also thermostats and solenoid or motor valves for space heating, air conditioning and refrigeration control.

Get the whole story by writing for bulletins 1025 and 1080.

### COMPANY, INC.

EMPIRE STATE BUILDING, NEW YORK 1, N. Y. SARCO CANADA LTD., TORONTO 8, ONTARIO REPRESENTED IN PRINCIPAL CITIES

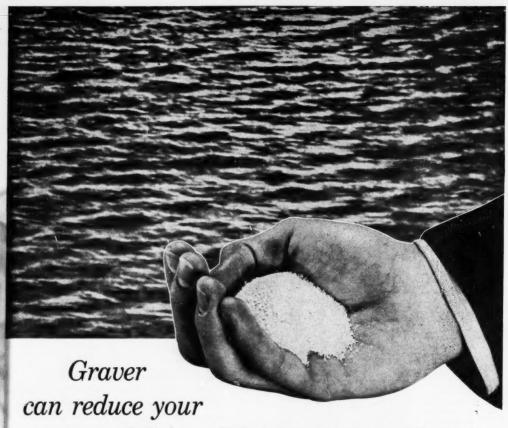
#### TYPE LSI .

An extremely sensitive and accurate Electric Indicating Temperature Controller for tem-peratures from minus 90°F to plus 650°F. Controls electric heating elements, motors, solenoid or motor valves to maintain constant temperature.

A built-in thermometer makes setting easy and provides a continuous check on temperatures maintained without the bother of continually changing charts.

A double switch type L2SI is available for alternate heating and cooling control, or step control of heating or cooling.





LESS THAN a handful in a million gallons

water solids to

That's equivalent to water with a purity of 0.1 ppm or 0.8 lb per million gallons . . . practically distilled water.

How does Graver do it? . . . with a MIXED-BED single tank demineralizing unit. Simple in operation, it can even be automatically controlled. Graver cation and anion exchange resins are mixed intimately, and simultaneously remove both cations and anions from the water being treated in this single unit. By combining certain Graver resins the silica in the water can also be reduced to 0.02 ppm and the carbon dioxide content can be reduced to zero.

Graver Demineralizers can accomplish these results in installations ranging in size from small laboratory units to huge plants in central power generating stations. The performance of each Graver installation is guaranteed . . . and this guarantee is based on Graver's 40 years of experience in designing successful water treating equipment of every type. Write for complete information.



### GRAVER WATER CONDITIONING CO.

Division of Graver Tank & Mfg. Co., Inc.

DEPT. CE-D 216 WEST 14th ST., NEW YORK 11, N. Y.

GW 440



tube

seal

announcing

stainless steel fitting for joining pipe or tube without threading or welding

Designed to reduce assembly costs and to permit the use

of less expensive lighter wall tubing. **Quikupl** stainless steel elbows, tees, couplings, reducers and adapters save you time, labor, materials and money.

**Quikupl** means lower installation costs! No threading, welding, flaring or other skilled assembly operations. Just cut to length and deburr.

**Quikupl** means lower material costs! Thin walled tubing can be used to maximum advantage.

**Quikupl** means economical maintenance! Downtime is cut to a minimum. Assembly and disassembly become a matter of minutes.

**Quikupl** means safe, leakproof connections! Synthetic sealing rings provide positive pressure-tight joints at all times.

**Quikupl** means simplified fitting inventories! Use it with schedules 5, 10, 40 and 80 pipe sizes without changing from one fitting to another . . . use it with a variety of tube wall thicknesses as long as the O.D. remains the same.

### TO GET THE FACTS

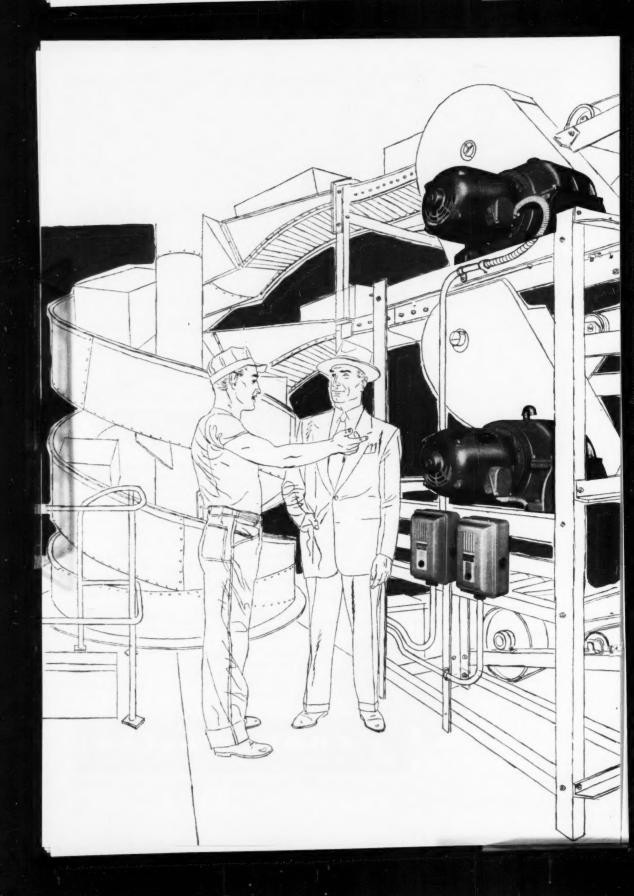
fitting

about this amazing new line of stainless steel fittings, write today for Bulletin Q100



COOPER ALLOY

LEADING PRODUCER OF STAINLESS STEEL VALVES, FITTINGS & CASTINGS



## "Conveyors keep 'em coming with this drive team cracking the whip"

"Here's a mighty important step in our production flow. A breakdown on this conveyor jams up an entire line . . . spells real trouble! That's why we installed Westinghouse Life-Line Gearmotors and Controls to handle the job. Past experience has shown us that this drive team will give continued, dependable service. We know they'll keep our output flowing smoothly without letup.

"All the gears are specially heat-treated with tapered hardness from surface to core to provide tough, wear-resisting teeth. They are hobbed and shaved after heat-treatment for quiet, smooth operation. All this adds up to precision gearing with maximum load carrying capacity. Supports for the antifriction bearings are mounted directly in the housing, not in end brackets, thereby providing permanent alignment of working parts and maximum overhung load capacity. As for the motors themselves, they're Life-Line too. Have all the

proved Life-Line features, such as factorysealed bearings, that need no lubrication ever, and steel construction that's so vital to dependable operation and long service life.

"Notice the Life-Linestarters! They have what it takes to stand up under constant usage. Each contact assembly pivots on a knife-edge of hardened steel. This reduces wear and leaves nothing to stick or jam. Contacts are silver tipped and are protected with the "De-ion" Arc Quenching Chamber which snuffs out those destructive arcs. All in all, these starters make a perfect matched control for the gearmotor. They're rough, tough and dependable. Just what we need on these important control jobs.

"These Westinghouse Gearmotors and Controls really form a drive team we can rely on. They'll do the same for you. Just call your Westinghouse representative for full details, or write: Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania."

J-07305





SPECIFICATION STEEL CASTINGS

SIVYER STEEL CASTING COMPANY • MILWAUKEE <\$> CHICAGO <\$> MAIN OFFICE: 1675 SO. 43rd St. • MILWAUKEE, WIS.

LADISH

Controlled Quality

PIPE FITTINGS

metallurgically
sound for
maximum service

Sound metallurgy... the result of unsurpassed facilities and advanced laboratory controls... provides the maximum of dependability in Ladish Controlled Quality fittings. Every phase of metal quality... composition, structure and physical properties... is continuously safeguarded—and certified proof of metallurgical integrity is available to users of Ladish fittings.

THE COMPLETE Controlled Quality FITTINGS LINE PRODUCED UNDER ONE ROOF...ONE RESPONSIBILITY

LADISH CO.

CUDAHY, WISCONSIN

District Offices: New York • Buffalo • Pittsburgh • Philadelphia • Cleveland • Chicago • St. Paul

St. Louis • Atlanta • Houston • Tuka • Ios Angeles • Hayang • Toronto • Mexico City





Photo courtesy of The Dow Chemical Company, showing standard method of packaging samples for mailing.

### Are your chemicals packaged as efficiently as these?

Does your present packaging method provide just the right amount of protection for your chemicals or chemical products? Is your packaging operation fast, easy—economical? As the illustrations show, these companies found a common sense answer in Kimberly-Clark Interior Packaging—KIMPAK\*. A modern cushioning material of unlimited versatility that could be "tailored" to fit their specific needs.

Available in rolls, sheets or pads in many thicknesses, KIMPAK is soft, clean, comformable. It's pleasant to handle, non-irritating, and easy to apply as wrapping paper. Kimpak is light—to save on shipping costs—yet efficiently cushions the product against shipping hazards. It absorbs up to 16 times its own weight in moisture within 30 seconds, to comply with Parcel Post regulations covering shipments of liquids.

So whether you package powders, capsules, tablets, granules—liquids in bottles, jars, tubes, vials or ampoules—KIMPAK can answer your specific needs, too, at lowest true cost. For complete information, write Dept. 0-9, Kimberly-Clark Corp., Neenah, Wis.



Photo courtesy of Trylon Products Corp. Tylo, a detergent in tablet form for dishwashing



Photo courtesy of Pennsylvania Salt Manufacturing Co. A chemical in granular form.



A Product of Kimberly-Clark

# SANTA CLAUS

# **Could Die of Old Age**

No one shoots Santa Claus. This remark about a government which spends and spends and spends may well be true. But it is also true that Santa Claus is an old man. At his age overwork might well kill him.

It is with the possibility of working Santa Claus to death that this editorial is concerned. No position is taken as between the contending political parties in the present campaign. Our concern is with the problem of protecting Santa Claus.

It is true that as a nation we now enjoy great prosperity. The prosperity is not nearly so general as the political advertisements of it would suggest. Millions of individuals, notably those living on pensions, annuities and other fixed incomes, have been robbed of half their purchasing power by inflation during recent years, and whole industries know little or nothing of boom times.

However, measured by so basic a gauge as unemployment, we do have great prosperity. Less than two million of our total working force of over 64 million are unemployed, and many of them are unemployed only while moving from one job to another. The real income, i.e., what their dollars will buy, of those with jobs is somewhere near its all-time peak.

# **Our Prosperity is Precarious**

The prosperity we enjoy, however, is precarious. This is primarily because it is dependent upon a rising volume of expenditures by the federal government. At present almost a quarter of our entire national income is ladled out through Washington, and in an ever increasing amount.

If, as matters now stand, federal expenditures were to be suddenly and sharply cut, our government-financed prosperity would be severely upset. But if the federal government were to try to keep right on providing prosperity by steadily increasing its expenditures, the end result would be more certainly disastrous. It would be a crash caused primarily by having continuing inflation of prices destroy the value of the dollar.

Higher government expenditures of worthless dollars then could accomplish nothing. Santa Claus would be dead from overwork.

### To Provide Firm Foundations

The general route to be followed in putting firm foundations under our prosperity is quite clear. It involves two steps which must be taken closely together. The first is to stop the continuous increase in federal expenditures. The second step is to substitute expanding private business for government-financed business as the principal foundation of expanding prosperity.

The increase in federal expenditures can be stopped without sacrificing any effective measures now directed toward meeting our top priority requirement—protection from armed Communist aggression. The most competent authorities of both major parties agree it can be done by (1) better planning of and the elimination of outright waste in defense arrangements, and (2) cutting those civilian expenditures which cannot be justified at the same time we are undertaking a great new load of defense expenditure.

It is also possible to substitute expanding private business for government-financed business. The problem is primarily that of relieving private business of the staggering load of federal taxation it now is carrying. Federal taxation now takes 52 per cent of all corporate profits and 82 per cent of all so-called excess profits. If it were not for the forced draft placed under our economy by rapidly mounting defense expenditures, this burden would surely lay a disastrous blight on private business expansion. If expanding private business is to have a chance to play its critical role as a subtitute for government-financed business, its taxes must be cut, and soon.

# It Won't be Easy

It would be naive to contend that it will be easy to check the expansion of federal expenditures. They have been running wild too long, and in the process contributing to a feverish, inflationary prosperity. Likewise, there is no reason to believe that the easing of the load of business taxes is going to be easy. The basic blight it puts on business expansion has been too long obscured by having our economy dosed with artificial stimulants, most notably enormous injections of federal expenditures.

# The Key Question - How Long?

It is obvious that prosperity is going to be a major topic of discussion in the present political campaign. There is nothing the matter with that. Prosperity is a key concern of the voters in choosing a national administration.

To make the discussion of prosperity really useful, however, it is important to ask and get answers to the right questions about it. The key question is not whether or not we have prosperity. That we have it in large measure is generally conceded.

The key question is, "How long can we continue to have prosperity?" The answer—not very long if we continue to rely primarily on new injections of inflationary federal expenditures. Santa Claus, be it remembered, is no youngster. If we continue our present improvident course, he will be worked to death. Those politicians, regardless of party, who see this clear danger and who have plans to escape it are facing up to the crucial question about our prosperity.

McGraw-Hill Publishing Company, Inc.



MUD HOG Crushers with traveling breaker plate



MIRACLE HAMMER Crushers for large capacities — large



Type A Crusher with swing



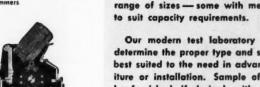
Single Roll, Double Roll and FLEXROLL Crushers

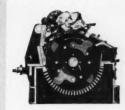
A Complete Line of crushers, pulverizers, shredders for reducing all classes of material to desired size. Several types are shown.

Built for specific applications — in a wide range of sizes - some with metal catchers -

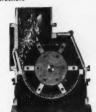
Our modern test laboratory enables us to determine the proper type and size of machine best suited to the need in advance of expenditure or installation. Sample of material may be furnished, if desired, with results kept in strict confidence.

CRUSHER DIVISION





**FLEXTOOTH and Rotary Ring** Crushers



Screenings Shredders for chips, sewage, etc.



Bale Breakers, Pulp Lap and Crude Rubber Shredders



Type B Crusher with swing



Type E Shredders for food or wood products



**FLEXTOOTH Metal Turnings** 



ROCKBUSTER for reducing hard, friable material



# Switchgear .. With Transfer Bus Assures Power Continuity WITHOUT THIS DUPLICATE SWITCHGEAR WHAT IS A

# Saves 1/3 the Cost

You pay only for the addition of the transfer bus... not a complete set of duplicate switchgear with all of its expensive components. At least one-third is saved on entire installation.

# Saves 1/2 the Space

Allis-Chalmers supplies transfer bus in same cubicle as switchgear, without adding cubicles . . . thus cutting floor space one-half.

# WHAT IS A TRANSFER BUS?

It's a by-pass bus circuit that parallels the main switchgear bus . . . with means provided for switching loads to the transfer bus. Also makes it possible to withdraw and maintain circuit breakers, or inspect main bus without power outage. This method proved by utilities in hundreds of installations.

Ask an Allis-Chalmers engineer about transfer bus arrangements and what they can mean to your plant in savings and service. And learn too about the unusual features that make it so easy to install A-C switchgear. Call your nearby Allis-Chalmers district office, or write Allis-Chalmers, Milwaukee 1, Wisconsin.

**ALLIS-CHALMERS** 



# N D U S T R I A L C H E M I C A L S

## FROM HARSHAW CHEMICAL

Electroplating Salts, Anodes and Processes **Driers and Metal Soaps** Ceramic Opacifiers and Colors Fluorides Preformed Catalysts, Catalytic Chemicals Glycerine Synthetic Optical Crystals **Agricultural Chemicals Fungicides Chemical Commodities** 

THE HARSHAW CHEMICAL CO.

# CLEVELAND 6, OHIO

# LABORATORY APPARATUS & CHEMICALS

# FROM HARSHAW SCIENTIFIC



Chemical Co. is a logical expansion of Harshaw's progress in the chemical field. Laboratories need apparatus and chemicals to carry on their work. Thousands of items are carried in stock by Harshaw Scientific. Your requirements can be filled, whether you need chemicals and apparatus for a single experiment, or to furnish a complete laboratory. Branch offices and stocks are maintained in convenient locations to help you obtain your require-

Harshaw Scientific Division of The Harshaw



ments within a short time.

DIVISION OF THE HARSHAW CHEMICAL CO.

Cleveland • Cincinnati • Detroit • Houston • Los Angeles • Philadelphia

chemicals

industry

laboratory

for

and



# FOR YOUR INFORMATION

Every meath Measante publishes these pages of information which may be helpful to you. This issue discusses:

Preventing Point Hilder Textile Scrap in Plastics Vorsattie Intermediate

Water-saluble Fertilizers Mineral Feed Supplements Plasticizer Extender AROCLORS for Contings, Pulet

Additional information on any of those subjects will be previded by any stansanto Sales Office or in response to your request by coupon or latter.

# MILMER 1 mildew-proofs paints



The difficult problem of making paint mildew-proof can be solved with Monsanto Milmer \* 1.

Paint on any surface exposed to excess humidity is particularly vulnerable to fungal attack, and research has shown that many of the outdoor painted surfaces, once thought to be discolored by dirt, actually were mildewed.

Previous attempts to develop fungusresistant paints usually failed because of one or more of the following reasons: Paint would "seal off" the fungicide and make it ineffective; the fungicide would ruin paint quality; or the fungicide was so highly toxic that it was difficult to use.

Milmer 1 has none of these disadvantages. It is effective in small concentrations (2% or less by weight), does not affect paint quality, and is essentially nontoxic to

higher animals. Milmer 1 is, by far, the most effective fungicide commonly used in paints.

Milmer 1 is easy to incorporate into paint formulations. It can be mixed with a suitable vehicle and ground like a pigment. Or, it can be added as a ready-to-use formulation.

Because of its nontoxicity and effectiveness, Milmer 1 is of special service in paints used by food processing plants, such as bakeries, dairies, meat packers, breweries, cheese plants, sugar refineries, cereal manufacturers and numerous others.

If you manufacture paints, mail the coupon for literature describing Milmer 1. If you are a user of paints, the coupon will bring you names of manufacturers offering paints mildew-proofed with Monsanto Milmer 1

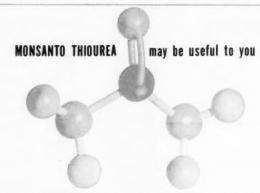
# SANTICIZER 8 helps turn textile scrap into useful plastics

What to do with scrap of polyacrylic-type and nylon-type textile fibers?

One textile manufacturer recently called on Monsanto Technical Service to help him answer that question. He was getting from 20% to 25% scrap of a staple fiber that was eosting him \$1.25 per pound.

Monsanto Santicizer\* 8 was found to be compatible with the fiber and, by rolling on a heated, 2-roll mill, a moderately flexible sheeting was produced. In addition, some tape was extruded. The finished plastic had excellent resistance to greases, hydrocarbons and other solvents and high resistance to abrasion. The flexibility could be adjusted by the amount of plasticizer.

If you have a problem of using scrap synthetic fibers, mail the coupon for more details.



In addition to its many proved uses in industry, Monsanto Thiourea may hold numerous undiscovered applications. Perhaps you can employ the chemical to your advantage.

Thiourea now is used in photographic chemicals; in high-quality thioglycolic acid for cold permanent wave solutions; in liquefying animal glue; in the manufacture of sulfathiazole, dyestuffs and resins. It is also used by the textile industry.

Monsanto Thiourea is available for immediate delivery in 75-pound bags. It comes as white, free-flowing crystals with a maximum of 0.50% moisture and 0.05% ash.

If you are a qualified chemist and interested in experimenting with thiourea, we will be glad to send you a sample. The coupon is for your convenience.



# Send for new booklet on Monsanto Penta

If you use wood for construction or in your products, you will find Monsanto's new, 16-page booklet, "For Maximum Wood Protection, Specify Penta," both interesting and useful. A copy will be mailed to you promptly if you will mail the coupon.

# Water-soluble fertilizers

To help meet increasing demands for plant nutrients, Monsanto has expanded production facilities of four basic soluble fertilizer chemicals—Mono Ammonium Phosphate, Di Ammonium Phosphate, Mono Potassium Phosphate, Phosphoric Acid 756%.

Greater availability of these basic fertilizer chemicals is of particular interest to fertilizer manufacturers who are developing new applications of high-analysis soluble plant foods which combine nitrogen, phosphorus, potash and, in many cases, herbicides and insecticides in addition.

Write for formulating information, with typical analysis chart.

# Dicalcium Phosphate mineral feed supplement

Feed manufacturers and formulators are turning to Monsanto dicalcium phosphate —made from 99.9% pure elemental phosphorus—because it is a quality mineral supplement of uniformly high phosphorus content... It contains phosphorus which is virtually 100% assimilable by the animal —produces results that growers can see ... Prompt deliveries, in 100-lb. bags and bulk carload lots, assured by Monsanto's

strategic, convenient plant location at Trenton, Michigan... Contact any Monsanto District Sales Office for added information.

# HB-40 Low-cost co-plasticizer

HB-40 is a low-cost, extender-type plasticizer that makes worth-while savings possible in processing vinyls—at the same time, it helps maintain product quality.

HB-40 is finding wide use in producing vinyl extrusions, vinyl pastes, vinyl slush moldings, vinyl calendering. It is also of special interest when used as a low-cost plasticizer in polystyrene casting resins, polystyrene adhesives, moiding polyvinyl carbazole, strip coatings for metals, floor tile compositions, asphalt base paints.

Full information on physical properties, application and use is contained in Technical Bulletin No. P-104.

# Some uses for AROCLORS

(chlorinated biphenyl and chlorinated polyphenyls)

The AROCLORS comprise a series of chlorinated biphenyl and chlorinated polyphenyls that have numerous applications in many industry operations. Important among these uses are —

In Pliolite S-5 and Marbon 9200... Contribute fast-drying properties and provide excellent protection against acids, alkali, moisture and other common corrosive influences. Ask for Technical Bulletin No. P-126.

In maintenance paints... Add resistance to water, acids, alkali—contribute to non-flammability, adhesion and gloss. Also used in modified and synthetic rubber coatings, lacquers, vinyl protective coatings. Ask for Technical Bulletin No. P-124.

As heat-transfer medium . . . AROCLOR\*
1248 is an ideal nonflammable-type liquidphase heat-transfer medium for temperatures up to 300° C. It has been used for
many years with gas-fired units in the
range of 200,000 to 400,000 B.t.u. per

hour —more recently in much larger units ... Contributes freedom from fire hazards; viscosities permit pumping at room temperatures; boiling point is sufficiently above 300° C. to assure a liquid condition at all times; vaporization losses are controllable. Ask for Technical Bulletin No. P-130.

# Important source of Sodium Phosphates

Monsanto is the world's leading producer of phosphates, including the sodium phosphates... Mined from huge deposits in Idaho and Tennessee, phosphorus matrix is converted to elemental phosphorus of better than 99% purity—this, in turn, is the source of phosphoric acid from which these phosphates are derived.

Monsanto sodium phosphates include — Mono Sodium Phosphate, Di Sodium Phosphate, Tri Sodi m Phosphate, Tetra Sodium Pyrophosphate, Sodium Acid Pyrophosphate and Sodium Tripoly Phosphate.

For details on Monsanto sodium phosphates and their varied applications, contact the nearest Monsanto District Sales Office or write direct to the Phosphate Division in St. Louis.

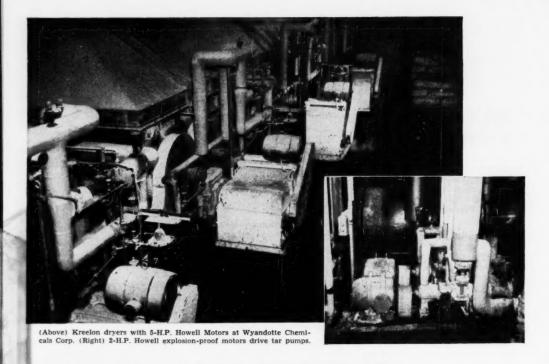
MONSANTO CHEMICAL COMPANY, 1700 South Second Street, St. Louis 4, Missouri. District Sales Offices: Birmingham, Boston, Charlotte, Chicago, Cincinnati, Cleveland, Detroit, Los Angeles, New York, Philadelphia, Portland, Ore., San Francisco, Seattle, Twin Cities. In Canada, Monsanto Canada Limited, Montreal.

\*Reg. U. S. Pat. Off.



SERVING INDUSTRY...WHICH SERVES MANKIND

SEND LITERATURE: Penta Booklet.  Milmer 1. Water-soluble Plant Nutrients.  Bulletin P-104. Bulletin P-126. Bulletin P-124. Bulletin P-130.	MONSANTO CHEMICAL COMPAN' 1700 South Second Street, St. Louis		
	Please send, without cost or obligati at left.	ion, information, lit	erature or sample as indicated
SEND INFORMATION:   Textile Scrap in	Name		Title
Plastics.  Suppliers of mildew-proof paint. Di Calcium Phosphate.  Sodium Phosphates	Company	//////////////////////////////////////	'9
or	Street		
SEND SAMPLE:   Thiourea.	City	Zone	State



# High demand for new detergent calls for uninterrupted production

## Howell Motors on the job in Wyandotte's new Kreelon plant

The Wyandotte Chemicals Corporation's new synthetic detergent and wetting agent, Kreelon\*, has become so widely accepted that steady production is absolutely essential to meet the demand.

Throughout the new Kreelon



Howell explosion-proof motor for hazardous locations.

plant, special machines of many types are in operation constantly. And as is often the case in chemical plants, the production of these machines is kept on schedule by the dependable power of Howell Motors.

Shown above are Kreelon dryers driven by 5-H.P. totally-enclosed, fan-cooled Howell Motors. In the same plant, explosion-proof motors in various sizes drive kerylbenzene, tar and caustic pumps.

Many other manufacturers in the chemical and allied fields, too, prefer Howell Motors. They like Howell's superior design, precision construction and low maintenance. They like the way these motors stand up and deliver unfailing power under tough conditions.

If your motor operations demand this performance, ask the Howell representative in your city to give you the facts on standard and special motors. Sizes from 1/6 to 250 H.P.; types for every application. You'll get immediate help by calling today or by writing direct to the factory. \*\*Neg. U.S. Pat. Off.. Wyundotte Chemicals Corp.



# HOWELL MOTORS

HOWELL ELECTRIC MOTORS CO., HOWELL, MICHIGAN Precision-built industrial motors since 1915

# Lined up for perfection ... in any service!

M.W. KELLOGG

In digestors for pulp mills . . . special towers for fatty acid splitters . . . refinery vessels, large and small ... in equipment for any processing task, Kellogg's accurate line-up techniques, preparatory to welding, pay off in peak operating performance and longer service life.

Pressure Vessels Vacuum Vassels Fractionating Columns **Drums and Shalls** Heat Exchangers Process Piping Hi pressure — Hi ter Power Piping Bends and Header Forged and **Welded Fittings** Radial Brick Chimneys









Special Welding Tech-



FOR OPERATORS IN WESTERN CANADA!

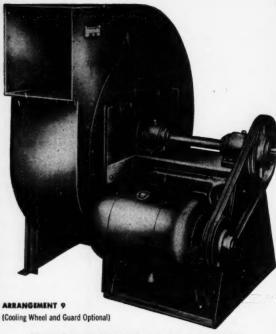
Canadian Kellogg Company Ltd. has blished complete shop facilities for the cation of all types of piping at \$888888. rts. Inquire directly or through any ogg or Canadian Kellogg office.

Fabricated Products Division, The M. W. Kellogg Company KELLOGG PULLMAN

New York, Jersey City, Les Angeles, Tulsa, Houston, Toronto, London, Paris-



# THER NEW STURTEVANT DEVELOPMENT!



The new Sturtevant Industrial Fan is available in four standard arrangements and a choice of three wheel types. It can be furnished for chain or belt drive as well as direct-connected motor drive.



### FOR EXHAUSTING

The Air Handling Wheel, with its backwardly inclined blades, gives you the highest operating efficiencies on the market today for general industrial air hanfor general industrial air nan-dling. It is particularly suitable for exhausting smoke, fumes, gases and light dusts from in-dustrial processes as well as for oven circulation, heat treating and drying applications. Power consumption is low over a wide range of volumes and pressures.



### FOR MATERIAL HANDLING

The Material Handling Wheel is a heavy-duty, radial-bladed, side-plate type designed for general purpose material handling. It is especially applicable to grinding and buffing wheel exhaust sys-tems, and for conveying such materials assawdust, granular particles and chips. This wheel combines high fan efficien-This wheel combines high fan efficiency with its material handling features.



### FOR SPECIAL APPLICATIONS

The Long Shavings Wheel is a material handling wheel without side plate. It has been designed particularly for those material handling jobs where long, stringy materials must pass through the fan.

# BUY A BETTER

# DUSTRIAL FA

# to do all these jobs:

- 1. Handle Air, Exhaust Fumes, Gases, Smoke
- 2. Remove Metal Dust, Chips, Sawdust, Grains
- 3. Convey Long, Fibrous Materials

Never before have you been able to find the combination of ruggedness, flexibility and high efficiencies now available in this new Industrial Fan. It has been designed for hard work-and performs on rough, tough industrial air handling jobs. It will help you to reduce operating costs by eliminating the manual or mechanical handling of many types of materials. It will help you to eliminate hazards and improve working conditions by exhausting fumes, dusts and vapors and performing many similar applications-all with a minimum of maintenance.

Here are ten top features which mean high efficiency, flexibility, and long life:



Streamlined inlet reduces losses caused by air turbulence, means new high efficiencies.



Sturdy welded fan housings eliminate air leakage, provide rigidity and eliminate vibration.



Fan wheels are of welded construction, with conical backplates for strength, and are statically and dynamically



Housings are convertible as to direction of discharge in all sizes. Inlet connection rings are in even inch sizes to accommodate standard sheet metal piping.



Extra heavy shafts maintain vibration-free operation. Cooling wheels and oil-lubricated ball bearings are provided for applications at elevated temperatures.



Available for belt or chain drives as well as direct-connected motor drive.



Large, heavy-duty, grease-lubricated bail bearings—one fixed, one floating—offset thrust and reduce maintenance.



Special protective coatings and special metals available to meet hazardous, explosive or corrosive conditions.



Wheels easily removed for cleaning and maintenance. Access doors also available for cleaning and inspection.



11 standard sizes with capacities ranging from 660 to 44,000 cfm and pressures up to 16<sup>8</sup> water gauge also 5 additional "made-to-order" larger sizes for special requirements. ter gauge:



These Fans are certified under the NAFM Standard Test Code and carry the NAFM Certified Ratings Label.

Just off the press, Catalog 1150 gives you 60 pages of complete application information as well as performance and dimension tables for all sizes and wheel types. For your free copy, call your local Westinghouse-Sturtevant Office, or write Westinghouse Electric Corp., Sturtevant Division, Hyde Park, Boston 36, Mass.

YOU CAN BE SURE ... IF IT'S

TUNE IN ON HISTORY! Only Westinghouse brings you complete coverage of political campaign over CBS television and radio.

HANDLI



FAIRBANKS-MORSE DIESELS CAN BE YOUR

# Power Keys

Here are the keys that have opened the way to adequate, reliable power for many plants — small and large. They have eliminated the penalty paid due to poor power factor, surge loads and adverse current characteristics.

But, Will They Fit Your Problem?

Look at the list! Would compact inplant power generation unlock your plans for plant expansion... eliminate the need of using purchased power at rates based on high peak demand values ... add to current capacity? The answer is yes—and it can mean the difference between profit and loss in your plant.

If you are seeking the keys to your power problem, write us today, outlining your needs. Fairbanks-Morse engineering can give you a proved answer . . . based on over 50 years' experience in industrial and municipal power generation. Fairbanks, Morse & Co., Chicago 5, Ill.



# FAIRBANKS-MORSE,

a name worth remembering when you want the best

DIESEL AND DUAL FUEL ENGINES . DIESEL LOCOMOTIVES . ELECTRICAL
MACHINERY . PUMPS . SCALES . RAIL CARS . MAGNETOS . FARM MACHINERY

Put Your Power Costs and Performance In Order

- Handle Peak Demand...reduce peak demand values for lower purchased power rates.
- 2 Power Factor . . . in-plant power generator can eliminate power factor penalties.
- 3 Emergency Power . . . insurance against lest production and damage resulting from line failures.
- 4 Handle Surge Loads . . . that may now be affecting current characteristics of entire plant.
- 5 Plant Expansion...need not be restricted dué to lack—or expense—of ample power.
- 6 Useful Heat . . . lube ell, water and exhaust heat can be turned from waste to profit.
- 7 Chemical Value . . . exhaust gases are high in free nitrogen—available for economical fixation of nitrates, ammonia, etc.
- 8 Insurance Advantage . . . of diesel over gasoline engine, for example, will soon pay for installation.
- 9 No Weather Worries...ice, snew, sleet, wind storms can't step plant operations.
- 10 Handle Increasing Load . . . in-plant power economically adds to current capacity as loads increase.
- 11 Fuel Economy . . . use diesel oil, natural gas or sewage gas for odded economy.
- 12 Remote Locations . . . distance from transmission lines needn't curtail plant expansion.
- 13 More Compact Power . . . Fairbanks-Morse engines give you more power per foot of floor space, more power on present foundation.
- 14 Minimum Attendance . . .
  Fairbanks-Morse in-plant generating sels require far less supervision or maintenance.
- 15 Save Cost . . . of running in new line where present transfermers and power lines are already loaded.

# **PENBERTHY Liquid Level Gages**



YOU CAN Remove and Replace Without Shutdown

Union connections between the gage and the valves permit removal of gage for repairs without shutting down the equipment. Just close the valves, uncouple the unions and remove the gage. The convenience of this is obvious. When glasses have to be replaced or repairs made, it is not necessary to work in an awkward position or to shut down. Another advantage: a gage needing repairs can be replaced immediately by a spare and the repairs made at leisure. There are many other reasons for the superiority of Penberthy Liquid Level Gages; ask for Catalog 35.

# OTHER PENBERTHY PRODUCTS



### PENBERTHY TRANSPARENT GAGE

Used to observe color and density of liquids under high pressures and/or temperatures. Exceptionally sturdy construction —liquid chamber machined from solid block of metal. Ask for Catalog 35.



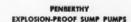
### PENBERTHY CYCLING JET PUMPS

Automatically operated by air, gas or steam pressure . . . Will pump without clogging any liquid that will flow through pipes. Ask for Bulletin 5030.



### PENBERTHY EJECTORS

A simple jet pump operated by air, water or steam, Needs no lubrication . . . will not get out of order, Made in wide variety of materials and special units developed to meet unusual conditions. Ask for Bulletin 512.



Motor and switch totally enclosed. Underwriter approved for Class 1, Group D, and Class 2, Groups E, F and G hazardous location. Made of copper and bronze throughout. Ask for Bulletin 4929.



4677



### PENBERTHY INJECTOR COMPANY

DIVISION OF THE BUFFALO-ECLIPSE CORPORATION

DETROIT 2, MICHIGAN

Established 1886

Canadian Flant, Windsor, Ontario

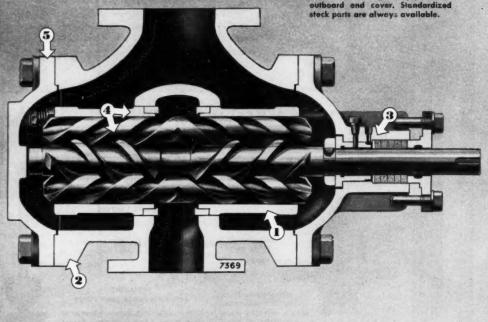
# DE LAVAL

# are versatile

Look at these design features

CAPACITIES TO 1,000 GPM PRESSURES TO 1,500 PSI

- (LINERS)—De Lavel is specially licensed by Mechanite to produce this high quality alloy iron.
- 2 MEEHANITE CASING—Simple, onepiece, rugged construction—hydrostatically tested to 150% of maximum working pressures.
- 3 STUFFING BOX—Extra deep, subject only to suction pressure. A needle valve controlled seal is provided for pumps operating on suction lift.
- 4 ROTORS AND HOUSINGS can be replaced without reboring the case or using oversize rotors.
- S EASY MAINTENANCE—To replace roters and housings, simply take off outboard end cover. Standardized stock parts are always available.



# "moving men" for viscous fluids



# Only 3 Moving Parts

The action of the De Laval-IMO pump is extremely simple. This unique pump has only three moving parts - a power rotor and a pair of sealing or idler rotors. There are no pilot gears, no sliding vanes, no reciprocating pistons . . . nothing to get out of order or need adjustment. Smoothly intermeshing IMO rotors propel the fluid axially without churning, pocketing or pulsation. There's no noise, vibration or hydraulic whine, even at high speeds. De Laval-IMO pumps are compact . . . can be directly connected to electric motors, turbines or other high speed drivers without reduction gearings, belts or chains.

Keeping viscous fluids "on the move" is a job De Laval-IMO rotary pumps do well throughout the process industries. Designed with the unique IMO principle, these quiet dependable pumps have proved their versatility in scores of applications. For example:

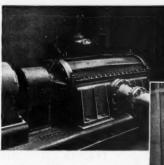
A bag manufacturer uses IMO pumps to remove paste from barrels and transfer it to the point of use on the machine. Each pump delivers approximately 2.5 gpm against 10 psi discharge pressure.

A sugar company specifies these rotary positive displacement pumps for handling molasses with a viscosity ranging from 17,000 to 25,000 SSU. Large IMOs deliver 350 gpm against a discharge pressure of 60 psi when operating at 280 rpm.

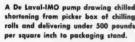
A synthetic fibre plant handles "slurry" running as high as 1,000,000 SSU with De Laval-IMO pumps. They reach capacities of 6-16 gpm at pressures as high as 450 psi at speeds of 150-450 rpm.

Several rayon mills have standardized on De Laval-IMO pumps for handling viscose. Models are available for capacities to 200 gpm against discharge pressures to approximately 160 psi.

These versatile pumps are also being used to handle varnish, liquid latex, glue, chilled shortening, linseed oil, resin, soya oil, corn syrup and many other viscous fluids. Models can be furnished for almost any fluid handling problem. Write for your copy of Bulletin LG describing the wide range line of De Laval-IMO pumps.



A 700 gpm transfer pump handling 8,500 SSU oil at 70 psi in a large midwest refinery.







**DE LAVAL** 

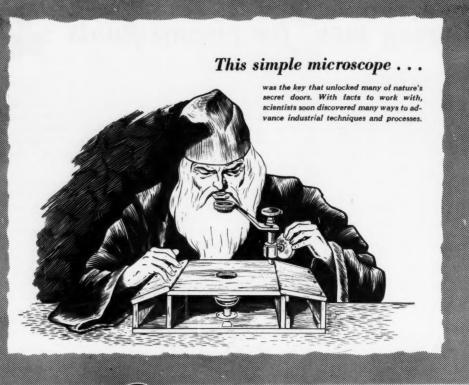
IMO Pumps





DE LAVAL STEAM TURBINE COMPANY

Trenson 2, New Jersey





As scientific research continually raised material standards, better machinery was needed to apply new methods to volume production. For a good part of our 50 years, Traylor has been building specialized equipment for the chemical processing industries. There's no substitute for experience in solving new production problems. Traylor has experience . . . half a century of it.

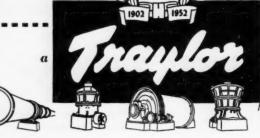


TRAYLOR ENGINEERING & MANUFACTURING CO.

471 MILL ST., ALLENTOWN, PA.

SALES OFFICES: New York • Chicage • San Francisce • Los Angeles.

Canadian Mfr.: Canadian Vickers, Ltd., Montreal, P. Q.



leads to greater profits









# How Standard's Jubrication service works for Studebaker

 Look almost anywhere in Studebaker's vast plant at South Bend, Indiana, and you'll see Standard's lubrication service at work.

In one of the many operating departments, the chances are you'll find the Standard lubrication specialist who serves Studebaker. He is assigned to the South Bend area and is close-at-hand to give Studebaker the lubrication engineering assistance they need when they need it.

Almost any day at Studebaker's, you'll see a Standard tank wagon or truck delivering the petroleum products that help keep production rolling. Because these deliveries are made from a nearby Standard warehouse, they are prompt and reliable. Most of the petroleum products used in the Studebaker plant are stocked in this warehouse and are immediately available.

All along Studebaker's assembly and production lines, you'll find Standard Oil products at work. From one of the most complete lines of fuels and lubricants on the market, Studebaker has been able to select the petroleum products that exactly fit its needs.

All of these benefits-expert engineering service, fast and reliable deliveries, a complete line of high quality products -add up to one of the reasons why Studebaker has been a Standard Oil customer for over 50 years. Make Studebaker's experience the basis for putting Standard's lubrication service to work for you. Just phone your local Standard Oil (Ind.) office and ask to have the Standard Oil lubrication specialist in your area call on you.

# What's YOUR problem?



Russ Jenkins (left), lubrication specialist from Standard's South Bend office, and Stude baker's Paul Izdepski work closely together to get best re sults from Standard's fuels and lubricants.

Wherever your plant is situated in the Midwest, there is a Standard lubrication specialist close-at-hand who will work hand-in-hand with you on lubrication problems. Right in your neighborhood, too, you'll find a Standard office and warehouse. It makes immediately available to you a reliable supply of pe troleum products. Phone your local Standard office soon, and find how you can profit through Standard's unique industrial lubrication service.

STANOBAR Grease is used through out the Studebaker plant for lubrication of bearings in electric mo tors and oil pumps. Its high sta bility enables it to provide effective lubrication under a wide variety of operating conditions.

STANWAY Industrial Oil. In many of Studebaker's grinding machines, STANWAY Industrial Oil No. 30H answers a special need by serving both as a hydraulic oil and as a lubricant for ways and guides.

The high stability necessary in a hydraulic oil and the oiliness needed in a way lubricant are uniquely combined in STANWAY.

STANDARD OIL COM





Corporation, P. O. Box 868, Pittsburgh 30, Pa.

WHAT Life-Lines REALLY DELIVER IS MORE SERVICE...LESS SERVICING



# FOR THOSE EXTREMELY CORROSIVE CONDITIONS... CONSIDER THE USE OF Amer-Plate

# Available in Two Convenient Types To Meet Your Needs

Plain AMER-PLATE for existing steel or concrete tanks or structures

Plain Amer-Plate is smooth and flat on both sides. It is applied to existing surfaces using specially developed cements that provide a firm bond with those surfaces.



### T-LOCK AMER-PLATE for newly cast concrete pipe and structures

T-shaped parallel "anchors" are an integral part and extend along the back of each Amer-Plate sheet. The sheet is applied to the inner forms of tanks, concrete pipe, and structures. When the concrete is poured, the tees are embedded and locked into the concrete.



# HERE'S A NEW, EXTRA-TOUGH, ECONOMICAL INDUSTRIAL SHEET LINING

Especially designed to protect against extremely corrosive conditions, Amer-Plate is particularly adaptable for use in highly corrosive sewers, chemical storage tanks, tank cars and tank trucks hauling unusually corrosive solutions.

Composed of inert resins and plasticizers, Amer-Plate is impervious to gases, highly resistant to acids, alkalies, alcohol, oils, salts, and petroleum products. It has a very low moisture vapor transmission rate, will not support combustion, and contains no toxic materials.

Amer-Plate is a flexible thermoplastic sheet, practical for application to flat, curved and angular surfaces. Its economy and effectiveness has been proved in the field in over 10 years of development and testing.

So... wherever you require long lasting protection against extreme corrosion, make a full investigation of the possibility of using Amer-Plate. Write for complete information.

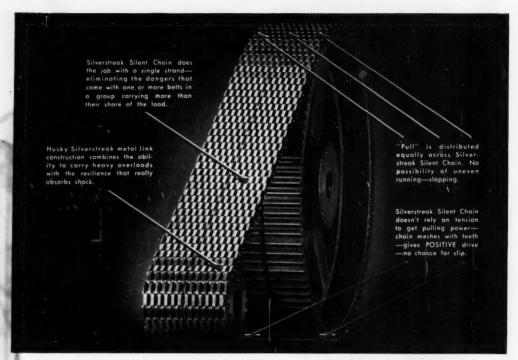
Amer-Plate industrial sheet lining is the result of many years experience in the manufacture and application of Amercoat protective coatings.

# AMERCOAT CORPORATION

A division of American Pipe and Construction Co.

4809 Firestone Blvd., South Gate, California

# Here's the <u>proved</u> way to transmit high hp at high speeds...



# Link-Belt Silverstreak Silent Chain drives are slip-proof...slap-proof...shock-proof

On thousands of applications . . . under all types of operating conditions—Link-Belt Silverstreak Silent Chain Drives have proved their effectiveness and durability. High horsepowers and high speeds are delivered with the same trouble-free efficiency (over 98 per cent) as on less demanding loads. There's a power-transmission engineer in the Link-Belt office near you.



SILVERSTREAK SILENT CHAIN DRIVES

12,528

LINK-BELT COMPANY: Chicago 9, Indianapolis 6, Philadelphia 40, Atlanta, Houston I, Minneapolis 5, San Francisco 24, Los Angeles 33, Seattle 4, Toronto 8, Springs (South Africa), Sydney (Australia). Offices, Factory Branch Stores and Distributors in Principal Cities.



As it has since 1940, a touch of the control button brings exact press speeds at the New York Herald Tribune. In those 12 years, there has been no replacement required on the two 100 hp Silverstreak Silent Chain Drives that power this press at chain speeds up to 3664 fpm.

# material handling expense

Material handling is non-productive labor that speeds up productive labor if you do it right.

Ajax Lo-Veyors are cutting costs of handling bulk materials in foundries, chemical processing, food plants, abrasives, ceramics and many other industries.

Ajax Lo-Veyors are made in a wide range of open and closed pan and tubular types to meet standard, sanitary, explosive, poisonous and corrosive conditions. They are complete units, easily installed on or below floor or suspended from wall or ceiling. Low installation and operating cost.

Write for your personal copy of Bulletin 39



AJAX FLEXIBLE COUPLING CO. INC.

WESTFIELD, N. Y.



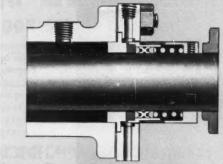
You've asked for them...
now BJ introduces these
special construction features!

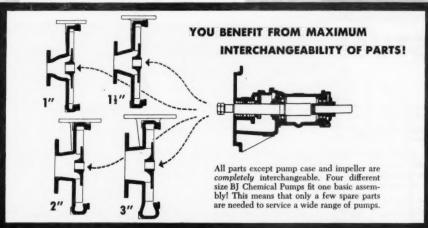
- juick and easy dismantling for inspection and repair without disturbing piping or driver.
- All parts interchangeable except pump case and impeller. Four different pump sizes can be used on one basic stuffingbox and bearing bracket assembly.
- Corrosion-resistant catch basin—integral part of pump case—guards bearing bracket and base plate from corrosive leakage.
- Adjusting sleeve permits compensation for impeller wear—allows easy adjustment without dismantling.
- Grease lubrication gives bearings greater protection against acid fumes. Deflector and labyrinth provide double protection against liquid entrance.
- Cored passages through impeller web keep stuffingbox under suction pressure.

# pumps engineered to your demands...

You—the chemical pump user—dictated the design of these new BJ Chemical Pumps. Before Byron Jackson engineered these new BJ models, chemical pump users were asked what features were wanted most. Now these improved features are yours in the new BJ Chemical Pumps. Four pump sizes are available (1", 1½", 2" and 3") with capacities to 450 gpm and heads to 100 feet.

BJ Mechanical Seal also available for protection against leakage. BJ's Type "A" Mechanical Seal is designed especially for the particular demands of chemical pumping. It replaces the packing and provides positive protection against leakage to the bearings or contamination of the pumped liquid. All major parts of this BJ-designed seal are effectively isolated from contact with pumped liquid. Available as special construction, the BJ Mechanical Seal will save you maintenance time and money by eliminating frequent repacking.





FOR MORE INFORMATION on these new pumps, write BJ Chemical Pump Dept. 5.

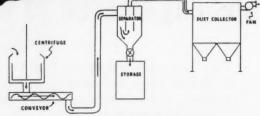
BJ makes a complete line of centrifugal pumps to answer your other pumping needs.

Byron Jackson Co.

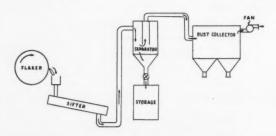
P. O. Bax 2017 Terminal Annex, Los Angeles 54, Calif.
OFFICES IN PRINCIPAL CITIES

A MIDWEST CHEMICAL CO.

\$112,500
annually
salvages
600,000 lbs.



Two complete Dustube Dust Control systems are used to eliminate dust nuisances in this midwest chemical plant. In one system about 25,000 lbs. of very fine material is handled daily. From 5% to 7% of this dust escapes preliminary separators and is trapped in a Dustube Collector. As this dust is worth 15c a pound, a minimum of \$187.50 is saved each day.



In the second system which ventilates chemical processing stations,  $\alpha$  minimum of 750 pounds of valuable material is recovered each day with a Dustube. At 25c per pound, the product recovered daily has a value of \$187.50.

# **DUSTUBE**

of chemicals with

dust control

The two Dustube Collectors installed at this chemical company have paid for themselves many times over with their thorough dust removal. As explained above, these collectors are saving \$375.00 daily in product recovery alone.

In addition, the Dustube Collectors' highly effective filtering action traps even the finest dust with virtually 100% efficiency to keep the plant completely dust free. Their simple, practical design provides the highest efficiency at an unusually low operating cost.

Let Dustube engineers show you why users everywhere say: "It pays to own a Dustube."





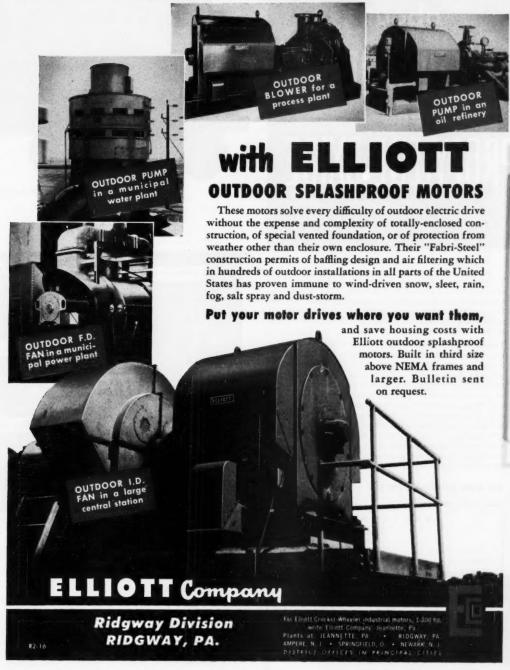
This new catalog explains how Dustube Collectors combine the proven efficiency of cloth filtration with a unique operating simplicity and economy, Write for your copy of Catalog 372.

American

WHEELABRATOR & EQUIPMENT CORP. 347 S. Byrkit St., Mishawaka, Ind.



# Put them outdoors...



# FACTS about ETHYLENE

PROPYLENE OXIDE

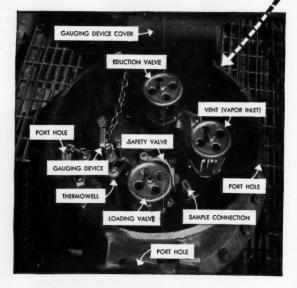
THE DOW CHEMICAL COMP

Today, more than ever, chemical materials should be used wisely and efficiently. The importance of Ethylene Oxide and Propylene Oxide to many industries has led Dow to believe that the following information may be of assistance in helping you realize greater value from these oxides.

Practically every major industry uses Ethylene Oxide or one of its many derivatives. Because Ethylene Oxide reacts with many other chemicals including fatty acids, phenols, alcohols and water, it is a basic component in many products. Ethylene Oxide is used in the manufacture of detergents... permanent antifreeze... cosmetics and bread conditioners. Propylene Oxide reacts with acids to form esters and with phenols to form phenoxy alcohols. In addition to the use of Propylene Oxide as an intermediate, it may be used as a low boiling solvent for cellulose acetate, nitrocellulose, vinyl resins, natural resins, hydrocarbons and as a sterilizing agent or product to inhibit the action of yeasts and molds.

THE DOW CHEMICAL COMPANY . MIDLAND, MICHIGAN

Ethylene Oxide	Propylene Oxide
Molecular Weight	58.1
Boiling Point	95.0°F.
Freezing Point. —168.2°F. Flash Point (TAG Open Cup). below—4.0°F. Fire Point (TAG Open Cup). below—4.0°F. Specific Heat, Btu/(lb) (°F.) 0.44	-169.6°F. below-21.0°F below-21.0°F 0.47
Heat of Vaporization (1Atm), Btu/tb245.0  Density, g/cc0.896 <sup>32°F</sup>	213.2 0.827 <sup>68°F</sup>
Refractive Index1.3614 <sup>39.2°F</sup>	1.36377°F
Explosive Limits (% Volume in Air)2—100	2.1-21.5
Water Solubility, g/100g at 77°F∞	59
Alcohol Solubility	00
Bher Solubility	00



# Unloading Tank Cars of Ethylene Oxide or Propylene Oxide

- The tank car should be accurately spotted on level track, the brakes applied, wheels blocked and appropriate caution signs displayed.
- Attach approved ground connections to tank car before any contact is made with unloading equipment.
- 3. Attach inert gas line to vent valve of tank car and attach unloading line to eduction valve. Attach pressure gauge to loading valve. (These lines should be flexible steel with steel fittings. Wrenches and other tools used around Ethylene or Propylene Oxide should be made of nonsparking metals.)
- 4. Open loading valve to activate pressure gauge.
- 5. Open vent valve slowly and apply inert gas pressure to car to force Oxide into pump suction and to keep vapor phase of



tank car out of flammable range. A rotary pump is recommended for transfer of these materials.

- When sufficient pressure has built up (about 35 psig) open eduction valve. This valve must be opened slowly so that excess flow check valve does not close.
- 7. Vent storage tank into which the Oxide is being pumped back into the tank car through the inert gas line. (The attachment of this vent line to the inert gas line must be made downstream from the compressor.)
- When tank car has been unloaded, close valves and detach unloading lines. Care should be taken to allow no air to enter tank car. The car, containing principally inert gas, is then ready for return to Dow.

### Handling Precautions:

Ethylene Oxide and Propylene Oxide are similar in many respects. Generally speaking, Ethylene Oxide is more reactive and more toxic than Propylene Oxide; however, the same general precautions should be applied to handling and working with both these chemicals. Ethylene Oxide and Propylene Oxide are highly flammable and highly reactive. Every precaution should be taken in handling these materials to avoid any source of ignition. Explosion-proof motors and other electrical equipment including pumps, piping, storage tanks, and compressors should be well grounded.

No copper or copper-base alloys or any other acetylide forming metals should be used in contact with Ethylene Oxide or Propylene Oxide. All equipment used should be free of acids, bases, salts and water since most of these act as polycondensation catalysts. Oils, grease, dirt, air, sulfur, ammonia and hydrogen sulfide should also be excluded from contact with Ethylene Oxide and Propy-

All new equipment or equipment which has been out of service should be thoroughly cleaned, dried and purged with an inert gas (i.e. Nitrogen or Methane) before being put into Ethylene Oxide or Propylene Oxide service. A blanket of inert gas should be kept on the Oxides to keep the vapor phase out of the flammable

Ordinary steel is acceptable for storage tanks and pipe lines. This equipment should be constructed to withstand an operating pressure of at least 50 psi. and should be insulated and provided with proper cooling equipment.

### Toxicity:

Ethylene and Propylene Oxides should be considered hazardous chemicals in both their liquid and vapor forms. The prolonged single exposure to gas concentrations of but a few hundred parts per million can have adverse effects, and regular daily exposure to low con-centrations should be avoided. The principal toxic effect resulting from inhalation is thought to be an irritation of the lungs which may produce, after several hours, inflammation and tissue destruction leading to pneumonia.

The following symptoms should be taken as evidence of excessive exposure: irritation of the eyes, nose and throat, headache, nausea, vomiting and weakness.

For emergency protection a full face gas mask with canister for organic vapors, or an air supplied respirator

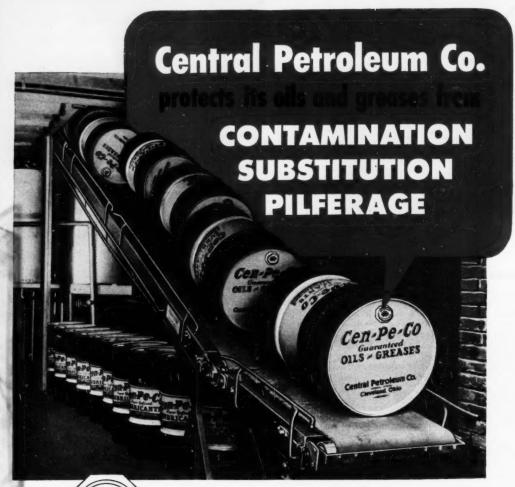
In the event of exposure, the casualty should be immediately removed from further exposure and placed under medical care. If liquid Ethylene Oxide or Propylene Oxide is spilled upon the person, all contaminated clothing should be removed at once and the affected area washed for several minutes with running water. Prolonged contact with the skin can cause severe blistering.

It is recommended that anyone who may be subject to exposure to Ethylene Oxide or Propylene Oxide be equipped with face shield, rubber gloves and other protective clothing.

## WRITE DOW FOR INFORMATION AND TECHNICAL ASSISTANCE.

Midland, Michigan	Company, Dept. OC-9,
Please send me	e additional information about Ethylene Oxide and de.
	reprints of this advertisement.
Name	Title
Company	
Address	
City	State





# Tri-Sure Closures guard every drum

For over 41 years the Central Petroleum Company, of Cleveland, has specialized in heavy-duty lubricants for tractors and trucks. Their Cen-Pe-Co Super-Refined Oils and Greases are used extensively because of their exceptional film strength—and because every gallon is *protected* by Tri-Sure\* Closures.

The Central Petroleum Company, like many other experienced shippers, has used Tri-Sure Closures

since their inception—because they are the proven way to prevent pilferage, contamination and substitution.

Give your products the security of Tri-Sure protection—a flange that is pressed into and integrally assembled with the drumstock; a plug that tightly engages with the flange; and a leak-proof, tamperproof seal. When you order drums, always specify "Tri-Sure Closures".

\*The "Tri-Sure" Trademark is a mark of reliability backed by 30 years serving industry. It tells your customers that genuine Tri-Sure Flanges (inserted with genuine Tri-Sure dies), Plugs and Seals have been used.

AMERICAN FLANGE & MANUFACTURING CO. INC., 30 ROCKEFELLER PLAZA, NEW YORK 20, N. Y.

Tri-Sure Products Limited, St. Catharines, Ontario, Canada

Your Management wants to know...

# How efficient dust recovery can mean new profits

In every industry, from chemicals to food to steel, Buell engineers, working with plant engineers, have established an enviable 18-year record of turning unnecessary dust losses into substantial new profits. What's more, Buell Dust Recovery Systems uncover, for all American industry, these additional important advantages: improved product quality, smoother plant-community relations and higher employee morale.

To take advantage of Buell's background and experience in the highly specialized science of dust recovery, ask for further information about Buell's 3 basie systems of dust collection. See how they can help you turn dust into dollars. Send for Buell's new, informative bulletin titled, "The Collection and Recovery of Industrial Dusts."
Buell Engineering Co., Dept. 12-I, 70 Pine Street, New York 5, New York.



VAN TONGEREN



'SF' ELECTRIC PRECIPITATOR



PRECIPITATOR-



TYPE 'LR'



DUST

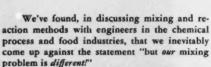




ENGINEERED EFFICIENCY IN DUST RECOVERY

# "Sure, <u>your</u> mixing problems are <u>DIFFERENT</u>

... that's why you need MIXING EQUIPMENT ENGINEERED to meet your specific requirements!"



Sure, your problem is different—having helped in the successful solution of hundreds of process mixing problems, we know how different these jobs can be . . . there are hardly any two that can be handled in exactly the same way. And because these mixing, blending, reaction jobs are so widely diversified, you need the kind of equipment and experience that will give you the best solution, in the shortest time, at the lowest possible cost.

That's where we come in. We have the production "know-how" and we have the equipment. Simpson Mix-Mullers are the answer to any mixing problem involving dry, semi-dry or pasty materials, and are without equal when it comes to thorough mixing and blending to exacting specifications . . . thanks to the controlled, proved Mulling Principle of Mixing!

What's more—these versatile, heavy-duty machines are the only muller-type mixers which can be equipped to function as reaction vessels . . . another fact proved in years of actual service.

Take a good look at the typical examples of the way in which Simpson Mix-Mullers are helping scores of widely diversified chemical process and food plants to do a better, faster mixing job at lower cost. Why not submit your mixing problems to us for analysis?

# we solved some typically different mixing problems



PILOT PLANT WORK...
View shows a laboratory
size Simpson Mix-Muller,
specially equipped for
mixing under vacuum and

specially equipped for mixing under vacuum and heat, in pre-testing trial batches in pilot plant work for electrical porcelain production.



**EXPLOSION-RESIST-**

ANT... This No. 0 Simpson Mix-Muller was specially equipped to reduce friction and heat to a minimum for the safe preparation of explosive materials. Completely jacketed for water circulation.



CORROSION-RESIST-

ANT...This No. 2 Simpson Mix-Muller has stainless steel mixing surfaces for corrosion-resistance and improved sanitation. Unit is also jacketed for circulation of steam to aid in chocolate preparation.



ELECTRICALLY-HEATED

... Special 24-in. laboratory size Mix-Muller, with thermostatically-controlled electric heating elements. Designed to operate under vacuum or pressure in preparing experimental batches. Equipped with stainless steel pan.



WATER-COOLED . .

These special No. 2 stainless clad Simpson Mix-Mullers are equipped with jacketed sides and bottom for full water circulation, to control heaf produced by chemical reaction in mixing of storage battery plate pastes.



HOT OIL CIRCULATION

... This versatile No. 00 Mix-Muller prepares an infinitely variable number of different mixes under widely varied conditions. Equipped for vacuum and pressure, and jacketed for hot oil circulation. Variable speed drive gives positive control over pilot mixes in large chemical plant.

use our Laboratory Service We maintain a completely equipped modern testing laboratory for determining the results of mixing different materials in Simpson Mix-Mullers. A confidential test in our laboratory will prove what a Mix-Muller will or will not do for you. Write for further details.

SEE "MULLING" DEMONSTRATED We invite you to see the "Mulling Principle of Controlled Mixing" demonstrated in Simpson Mix-Mullers at the Chicago Chemical Exposition, September 9-13, BOOTHS 233-234.

We will welcome an opportunity to discuss your "different" mixing problems with you. If you do not plan to be in Chicago, a letter or a phone call will place our experience at your disposal.



SIMPSON *MIX-MULLER*®DIVISION

NATIONAL ENGINEERING CO., 604 Machinery Hall Bldg., Chicago 6, III.





In Coal-Tar Chemicals Quality must be proved by performance

# **BUY BARRETT** AND BE SURE!

When you buy from Barrett, you get uniform quality resulting from Barrett's basic position in raw materials and nearly 100 years of experience in the manufacture of coal-tar products.



### BARRETT DIVISION ALLIED CHEMICAL & DYE CORPORATION

40 RECTOR STREET, NEW YORK 6, N. Y.

In Canada:

The Barrett Company, Ltd., 5551 St. Hubert St., Montreal, Que.

### Barrett\* coal-tar chemicals

Phenols Cresols Cresylic Acids
Xylenols
Pickling Inhibitors Benzol Toluol

Toluol
Naphthalene
Hi-Flash Solvent
Phthalic Anhydride
Dibutyl Phthalate
ELASTEX\* DCHP Plasticizer
"ELASTEX" 10-P Plasticizer (DIOP)
"ELASTEX" 28-P Plasticizer (DOP)
Phonolic Rasins

Phenolic Resins
Niacin (Nicotinic Acid)
Isonicotinic Acid
Pyridines
Picolines

Picolines
Quinoline
Lutidines
Tar Acid Oils
Neutral Coal-tar Oils
Coal-tar Creosote
CUMAR\* Paracoumarone-Indene Resin
Carbones\* Rubber Compounding
Hydrocarbon
Bardol\* Rubber Compounding Oil
Flotation Agents

\*Reg. U. S. Pat. Off.





ESCO STAINLESS AND HIGH ALLOY STEELS

# ELECTRIC STEEL FOUNDRY

2143 N. W. 25th Avenue, Portland 10, Oregon

Sales Offices and Warehouses

DANVILLE, ILLINOIS HONOLULU, T. H. HOUSTON, TEXAS LOS ANGELES, CALIFORNIA EUGENE, OREGON NEW YORK CITY, NEW YORK SAN FRANCISCO, CALIFORNIA SEATTLE, WASHINGTON SPOKANE, WASHINGTON MEDFORD, OREGON

IN CANADA \_ ESCO LIMITED, VANCOUVER and TORONTO

# PIPE FITTINGS of STAINLESS STEEL

You still can get the ESCO stainless steel pipe fittings you need. These are carried in warehouse stocks throughout the country in both screwed and flanged types...in full range of shapes and sizes...in standard corrosion resisting analyses. Special sizes, types and analyses are produced subject to N.P.A. regulations governing critical alloys.

Also available on short notice are stainless flanges cast for pressures of 150 to 900 pounds; sizes from  $\frac{1}{4}$ " to 16"; standard or special analyses.

Detailed information on pipe fittings and flanges are contained in the comprehensive new catalog "ESCO Stainless and High Alloy Products". A copy will be given you upon request. Ask your nearest ESCO representative, or use the coupon below.

ELECTRIC STEEL FOUNDRY	
2143 N. W. 25th Avenue, Port	land 10, Oregon
Please send me a copy of your High Alloy Products**	catalog, FSCO Stainless and
Name	
Company	
Address	Zone.





able units; main bus completely accessible; incoming line connections are easily made.



EASY TO WIRE. Four-inch wiring trough; components accessible from all sides; front-connected starters; doors swing more than 90°.

FORD MOTOR COMPANY OFFICIALS INSPECT THE INTERCHANGEABLE UNITS OF THE . . .

# **New G-E Motor Control Center**

Since January, over 10,000 men from production and management of leading industries (see above) have taken a thorough look at the latest equipment for the centralized control of a-c motors up to 200 hp. Their reports indicate enthusiastic approval of what they saw. Here's why:

VERSATILE. Because units are easily interchangeable without waste space, a variety of arrangements can be made. For example—two Size 1 or 2 starter units require the same space as a Size 1, 2, or 3 reversing starter.

ACCESSIBLE. A four-inch continuous wiring trough provides ample wiring space. Components are mounted on an easy-to-handle frame and accessible from all sides when lifted from cabinet. Starters are front-connected. Master terminal boards can be swung out of compartment for extra working space around conduit.

PROTECTED. Will withstand 25,000 amperes RMS short-circuit current, substantiated by certified Laboratory

For more information on this new G-E motor control center, contact your nearest G-E apparatus sales office or write for Bulletin GEA-4979A today. General Electric Company, Schenectady 5, N. Y. 730-42

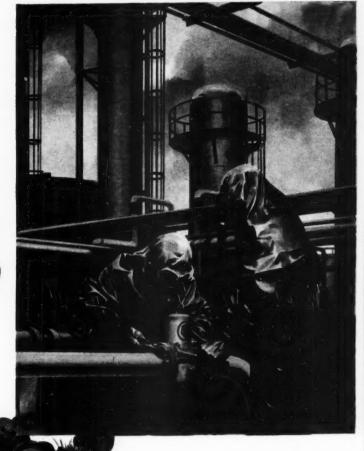


EASY TO SERVICE. Units are easily disconnected from bus and locked in test position (above). Barriers between units are easily removed to facilitate wiring (below).



GENERAL (%) ELECTRIC

WHAT!
MAKING
AVIATION
HISTORY?



Not as spectacularly as the Wright Brothers,
La Coste, or Lindbergh, but Cameron has helped make
aviation history, too. When the need for
aviation gasoline became critical during the war, and
again in the last year or two, alkylation units sprang up
almost overnight. With them came the need for
valves to handle the corrosive catalysts—hydrofluoric and
sulfuric acid. The Cameron Non-Lubricated Lift-Plug Valve was
designed specifically for that service. Test installations
quickly proved that the lift-turn-reseat principle of this
valve, which requires no lubricant, together with its separate, renewable
seat which permits any desired trim to resist corrosion, was
ideal for alkylation service. The advantages of this remarkable
valve have since been recognized by all divisions of the petroleum,
chemical, and process industries.

Why not profit by this years ahead design in your operations?

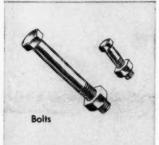
World Leader in Pressure Control

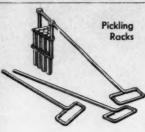
C. I. W., Inc., P. O. Box 1212, Houston, Texas Export: 7912 Empire State Bldg., New York, N. Y. Cameron

IRON WORKS

INCORPORATED









# **HAYNES Alloy Bar Stock**

# FOR SEVERE SERVICE CONDITIONS

Four different HAYNES alloys are available in hot-rolled and forged bar stock for the fabrication of parts subjected to heat, corrosion, or oxidation. Each alloy has an unusual combination of properties to combat certain severe service conditions, as indicated by the chart below. Typical parts made from HAYNES alloy bar stock are piston rods, valve stems, pickling racks, pump shafts, bolts, needle valves and forgings such as automotive valves and turbine blades.

Round bars are available in diameters from  $3\frac{1}{2}$  in. down to  $\frac{1}{4}$  inch. Rounds larger than  $3\frac{1}{2}$  in. in diameter can be obtained as hot forgings.

HAYNES alloy bars can be turned, ground, drilled, tapped, reamed, threaded, and welded.

For further information about HAYNES alloy bar stock, contact the nearest Haynes Stellite Company district office.

### USE BAR STOCK OF

# HASTELLOY Alloy B (nickel-molybdenum-

# HASTELLOY Alloy C

(nickel-molybdenumchromium-iron)

# MULTIMET Alloy

(cobalt-chromiumnickel-iron)

### HAYNES Alloy No. 25

(cobalt-chromiumtungsten-nickel)

### FOR RESISTANCE TO

Hydrochloric acid, wet hydrogen chloride gas, sulphuric acid, phosphoric acid, organic acids, high temperatures.

Nitric acid, free chlorine, acid salts, hydrochloric acid, sulphuric acid, phosphoric acid, organic acids, sulphurous acid, high temperatures.

Oxidation, high temperatures.

Oxidation, high temperatures, carburization, wet chlorine, nitric acid.

HAYNES

alloys

# Haynes Stellite Company

A Division of
Union Carbide and Carbon Corporation

General Offices and Works, Kokomo, Indiana Sales Offices

Chicago — Cleveland — Detroit — Houston Los Angeles — New York — San Francisco — Tulsa

"Haynes," "Hastellay," and "Multimet" are trade-marks of Union Carbide and Carbon Corporation.



The ingenious, simply-designed mechanism of Fisher Wizard Controllers provides extreme accuracy and dependability in pressure control.

Fisher Wizard Controllers will completely solve your pressure control problems. They are individually built to meet your exact operating conditions, and are guaranteed to give satisfactory performance. High pressure Fisher Wizards are available in throttling and snap acting types. Bourdon Tube pressures from 5 to 10,000 P.S.I. Diaphragm or remote panel mounting.

Low pressure Fisher Wizards available in diaphragm or remote panel mounting. Bellows pressures from ½ to 15 P.S.I.

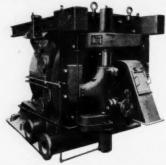
FISHER LEADS THE INDUSTRY IN RESEARCH FOR BETTER PRESSURE CONTROL



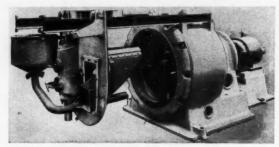
FISHER GOVERNOR COMPANY

Marshalltown, lowa

# Convestigate THE MECHANICAL ADVANTAGES OF REINEVELD CENTRIFUGALS



A modern 50" Reineveld Centrifuge showing the hydraulic control piping, main slurry filling pipe and the wash water pipe.



A 36" Reineveld, steel construction, rubber lined Contrifuge. The cover is shown part way out exposing the knife for easy replacement.

MAIN BEARING AT THE CENTER OF GRAVITY OF THE ROTATING MASS ... This patented feature allows Reineveld's exclusive processing method which makes possible the formation of a superior filter bed and a higher safe operating speed, assuring freedom from vibration.

DESIGN FEATURES . . . All Reineveld Centrifuges and Separators are constructed to American engineering standards and with ample safety factors. The base and front cover of all Reineveld machines are made of cast iron in Reineveld's own foundry. All parts of these time-proven machines are built of highest quality material made to give excellent service over a long period of time. Either direct-coupled or V-belt drive can be used.

PRECISION STANDARDS . . . Reineveld's factory has been entirely equipped with new, modern machine tools since the end of World War II. A thorough inspection system checks tolerances on all manufactured parts . . . and every machine is completely assembled, tested and "run-in" to make sure of its satisfactory operation.

require no maintenance other than the occasional sharpening of a dull knife and, on some products, the periodic changing of the filter cloth. On the smaller machines the entire front cover rolls out on a pair of overhead rails to allow easy replacement of the knife or filter cloth. This entire maintenance operation requires a total "down" time of only 20 minutes. On the larger machines adequate space is provided in the front cover to make these changes.

SIZE RANGE . . . Reineveld machines range in drum diameter from 36" to 79". This wide selection of sizes allows the most economical installation for each application. One large Reineveld machine can often give more production than several smaller machines.

The mechanical superiorities of Reineveld machines and the processing advantages of the improved filter bed and the higher safe operating speed combine to produce . . . lower impurities . . . lower maintenance . . . drier product . . . and greater production in any size Reineveld machine.

Write for Booklet 7-RC-2



## Sulphur

Thousands of tons

mined daily,

but where does it all go?

THE DEPARTMENT OF AGRICULTURE reports that in 1950 some 336,000,000 acres of land in the United States were under crop cultivation. That's a lot of acreage.

But where, you might ask, is the connection with Sulphur? Fertilizer, to take just one phase of agriculturally-used chemicals in which Sulphur was used either as a component part or as a processing element Superphosphate, the base of the most widely used manufactured fertilizer, requires about 200 pounds of Sulphur for every ton produced.

Consideration of the vast tonnage of fertilizer used in agriculture — and dosages range from a few pounds to a ton or more per acre — gives an idea of the overall requirement of Sulphur for this one division of industry. And to fertilizer you have to add all the insecticides and fungicides which are either sulphur derivatives or have used sulphur compounds in their preparation.

Agriculture is just one of the many destinations of great tonnages of Sulphur.

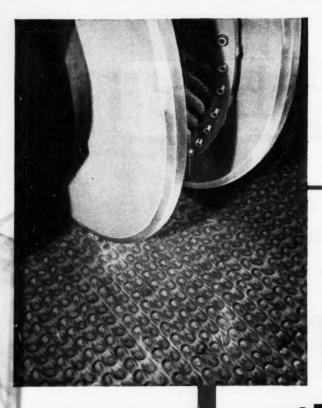
Photograph above shows our loading dack at Galveston, Texas



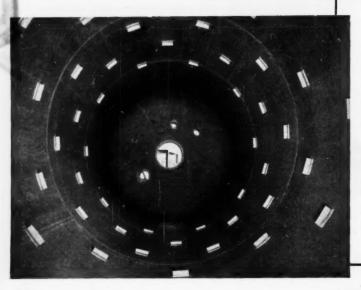
75 East 45th Street, New York 17, N. Y.

o. (5)

Mines: Newgulf and Moss Bluff, Texas



# Plus Values of Baw CROLOY-



So effective is the bond between base metal and alloy liner in B&W Croloy-Clad pressure vessels that inside welded assemblies are attached directly to the stainless "skin." This faster. more economical and efficient type of assembly leaves the corrosion-resistant lining intact . . . eliminates cutouts and welding to base metal . . . avoids the accelerated local corrosion that may result from alternative practices.

B&W Croloy cladding and base plate are permanently bonded with resistance welds • Bond withstands repeated heating and cooling • High strength of bond permits direct welding of internal fittings to Croloy lining • Uniform clad protection over full plate • Full corrosion resistance retained by heat treatment • No interface carbon migration between base metal and Croloy lining • Fabricates as easily as plain steels, and without special precautions • Provides all advantages of solid alloy protection at a great saving in cost

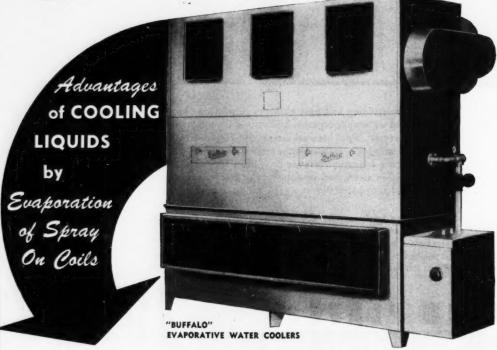
These features briefly explain why pressure vessels and other processing equipment built of B&W Croloy—Bonded Plate are paying dividends in dependable, lasting contact-side protection against corrosive

and oxidizing conditions. Ask for Bulletin S-14. The Babcock & Wilcox Company, Process Equipment Department, Barberton, Ohio.





## Tips on Better AIR CONDITIONING



- EFFICIENCY fine spray evaporating on spiral fin coils gives efficient cooling action.
- 2. GOOD CAPACITY RANGE— "Buffalo" EWC sizes range from 20 to 600 gpm of cooled liquid.
- 3. COMPACT SIZE—easily moved into buildings, installed near related equipment. Indoor or outdoor installation.
- 4. EASY OPERATION "Buffalo" Evaporative Water Coolers require little attention may be equipped with automatic damper controls.
- 5. SIMPLE MAINTENANCE spray on coils keeps them clean. Quality "Buffalo" Pumps, Fans and non-clogging spray nozzles in these EWC units are trouble-free essential parts.
- 6. WRITE for further facts on liquid cooling for air conditioning. "Buffalo" Evaporative Water Coolers and Evaporative Condensers are widely used in the refrigeration field.

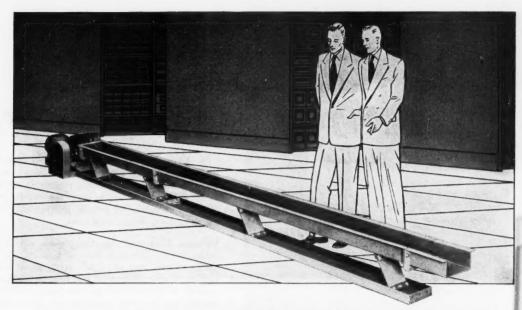


BUFFALO FORGE COMPANY
SOL BROADWAY

PUBLISHERS OF "FAN ENGINEERING" HANDBOOK
Canadian Blower & Forge Co., Ltd., Kitchener, Ont. Sales Representatives in all Principal Cities

PRESSURE BLOWING

COOLING AIR TEMPERING HEATING INDUCED DRAFT FORCED DRAFT EXHAUSTING



## Now you can buy FLEXMOUNT Oscillating Conveyors "right off the shelf"

## Stock sections make FLEXMOUNT Positive-Action Conveyors easy to order...easy to install

Yes, you can now get FLEXMOUNT Oscillating Conveyors for immediate delivery from stock. There's no more waiting for special engineering—stock sections are easily built up to any length desired.

This off-the-shelf service applies to 8, 12 and 18 in. trough widths. For greater capacities, Link-Belt has heavy-duty designs. All offer lower handling costs . . . make many difficult conveying jobs practical for the first time.

Link-Belt test units and laboratory facilities are available for your use. Our engineers will be glad to demonstrate how FLEXMOUNT Oscillating Conveyors can serve your requirements.

Versatile, low-cost FLEXMOUNT Conveyors are easily kept clean, can be made dust-tight if desired. For all the facts, write for your copy of new Book 2478.



Note the compactness of this dust-proof enclosed FLEXMOUNT Oscillating Conveyor. All-metal trough is self-clearing.

## How Positive Action moves material...



Positive-action, constant-stroke eccentric drive provides a powerful, yet gentle upward and forward oscillating motion. Large volumes of material are moved in a uniform, continuous flow, regardless of surges. Natural spring action of resilient legs reduces power requirements to a minimum.

## LINK BELT

#### FLEXMOUNT OSCILLATING CONVEYORS

LINK-BELT COMPANY: Plants: Chicago, Indianapolis, Philadelphia, Atlanta, Houston, Minneapolis, San Francisco, Los Angeles, Seartle, Toronto, Springs (South Africa), Sydney (Australia), Sales Offices, Factory Branch Stores and Distributors in Principal Cities.

## Applications Unlimited...

## wherever you need to measure,

. . choose

Electronik Potentiometers WHETHER charting the course of an experiment on a laboratory bench, or regulating huge-scale production in a sprawling processing plant, *ElectroniK* Potentiometers point the way to accelerated research, to greater productivity, to higher quality, and to lower costs.

Versatile *ElectroniK* Instruments are supplied calibrated for variables such as pressure, temperature, level, flow, pH, conductivity, speed and motion. A wide selection of instruments provides a choice of indicators, single and multi-point recorders, and a variety of electric and pneumatic



#### PRECISION INDICATOR

centralizes up to 48 different readings on one instrument; just press a button and wide-open scale turns quickly to measured value.



#### INDICATING CONTROLLER

set point and measured values are easily read on 2½-foot circular scale. Supplied for on-off and proportional electrical control.



#### record or control

controllers from the simplest to the most complex types. In all these, the *ElectroniK* "continuous balance" measuring system, with electronic noncyclic balancing, affords the peak of speed, sensitivity and service-proved dependability.

Plan now to gain the full benefits of automatic instrumentation throughout your plant. Call in your local Honeywell engineer . . . he is as near as your phone.

MINNEAPOLIS-HONEYWELL REGULATOR Co., Industrial Division, 4478 Wayne Avenue, Philadelphia 44, Penna.

#### Of special interest to research men...

#### FUNCTION PLOTTER

automatically charts temperature vs. expansion, speed vs. torque, stress vs. strain. One variable actuates the pen, the other actuates the chart drive.

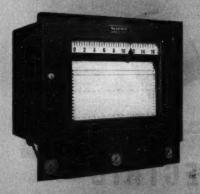
#### DUPLEX RECORDER

simultaneously records any two independent variables. Two pens actuated by separate measuring systems can both travel full width of the chart.

#### ELECTROMETER

records currents as small as 10-15 amperes, for measurements with ionization chambers, spectroscopes, etc.; features fast response, low noise, high stability.





#### Recorders

Circular chart type with 28 %" scale can be read at a distance. Strip chart type records as many as 16 points. Scanners available for larger number of points. Pen speeds as fast as one second.

#### **Electric Controllers**

Circular chart and strip chart types are supplied for on-off and proportional control...

Electr-O-Line for position-proportioning,
Electr-O-Pulse for time-proportioning.

#### **Pneumatic Controllers**

Choice includes on-off control, Limited Throttlor and Full Throttlor controllers with manual reset, Air-O-Line Controller with automatic reset. Rate action is optional.

Honeywell

First in Controls

For a brief description of all Honeywell Instruments, write for Composite Catalog 5000.



DRAW-OUT TYPE AIR CIRCUIT BREAKER pulls out for inspection—can be easily replaced with a spare if maintenance is required. Modern metal enclosed units with no exposed live parts provide maximum safety.

# Order by number—

#### save weeks on delivery

Look at the catalog, pick out the ratings for the number of feeders you require, and just order by number! That's all you have to do to get modern G-E low-voltage air circuit breaker equipment delivered in minimum time.

Cataloged standards give you pre-engineered, high quality equipment. And they are available for quick delivery because of the reduction of engineering and manufacturing time made possible by repetitive manufacture.

## G-E Standardized Air Circuit Breaker Equipment

600 volts maximum—interrupting ratings 15,000 to 50,000 amps.

Cataloged equipments offer a wide choice of arrangements. They are listed in groups, with various combinations of manually or electrically operated breakers—either with or without instrumentation. Each group number covers a complete switchgear unit, fully co-ordinated, factory-assembled and ready to install. Any number of units can be combined in one line-up to form a complete switchboard.

For full information, contact your nearest G-E apparatus sales office, agent, or distributor, or write to General Electric Company, Schenectady 5, New York. 860-42.



"Cataloged Drawout Air Circuit Breaker Equipment"

With this publication, you can order G-E air circuit breaker equipment by catalog number. Write for GEC-849.

GENERAL



ELECTRIC



## Specialists in ENGINEERING APPLICATIONS TO MEET YOUR PARTICULAR NEEDS . . .

. . . yes, DOWNINGTOWN's experience and research in the fabrication of various grades of Carbon Steel, Stainless Steels, Nickel-Clad, Stainless-Clad, Monel-Clad, Cupro-Nickel, Aluminum, etc., may be of help to you. We are equipped with the most modern facilities to handle complete jobs, within our limitations, in the correct alloys and methods of fabrication required to assure maximum operating efficiency.

DOWNINGTOWN also maintains a Heat Transfer Division under the direction and supervision of men thoroughly trained and experienced in this field. Our Engineering Consultation is at your service to aid you in preparation of plans and specifications for definite jobs.

Useful literature sent upon request on your business letterhead. Remember: "Your needs are our Specialty!"

NEW YORK OFFICE, SO CHURCH STREET

DOWNINGTOWN IRON WORKS, INC.

DOWNINGTOWN, PA.

STEEL \* ALLOY PLATE FABRICATION
HEAT EXCHANGERS

304 Stainless.



September 1952—CHEMICAL ENGINEERING

... or a 10t...

GET YOUR VACUUM
WITH

# ELLIOTT Steam Jet EJECTORS

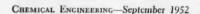
• If it's low vacuum, with intermittent service, a small priming ejector, as illustrated at left, may do the job. If it's extremely high vacuum, constantly maintained, a multi-stage installation of large ejectors, complete with intercondensers, may be called for. In short, Elliott ejectors — and the "know-how" that goes with them — cover the entire range of commercially obtainable vacuum, including such conditions as the handling of highly corrosive vapors.

Elliott Company's position in the field of vacuum equipment and its application has been a development of years. The resultant valuable experience is at your service with no obligation.

## INDUSTRIAL PROCESS DIVISION JEANNETTE, PA.

PLANTS AT: JEANNETTE, PA. • RIDGWAY, PA. AMPERE, N. J. • SPRINGFIELD, O. • NEWARK, N. J.

District Offices in Principal Cities





A bove are shown a few photographs of a successful installation of Cochrane Water Conditioning Equipment at Jones & Laughlin Steel Company, Aliquippa, Pa. In one of their processes, they were using large quantities of condensate, but a recent plant expansion curtailed the supply. To furnish water free from dissolved solids, they installed two Cochrane Sludge Contact Reactors, to-

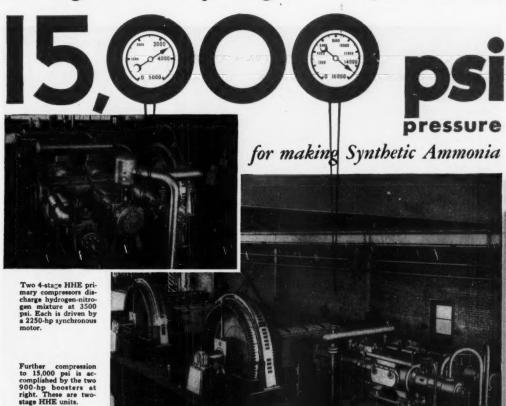
gether with a Cochrane Demineralizer. Effluent from the Reactors, unfiltered, is clear enough for the first step in the process, averaging as it does, only 5 ppm. of suspended solids. The further purified water from the Cochrane Demineralizer is used in the final step of the process. Write for details of the Cochrane demineralizing process. Answers to your specific problems also will gladly be furnished.

COCHRANE CORPORATION, 3117 N. 17th St., PHILA. 32, PA. In Canada: Canadian General Electric Co. Ltd. • In Mexico: Babcock & Wilcox de Mexico. S. A., Mexico City • In Europe: Recuperation Thermique & Epuration, Paris.



Central Panel Board for Cation and Anion Units.

## Nitrogen and Hydrogen Compressed to



## Ingersoll-Rand solves another high-pressure problem...with new HHE compressor installation at Mississippi Chemical Corporation

When nitrogen and hydrogen are brought together under the proper condition of pressure and heat in the presence of a catalyst, the reaction yields ammonia. In the synthetic ammonia plant of the Mississippi Chemical Corporation, at Yazoo City, Miss., these two gases are mated at 15,000-psi pressure . . . with the aid of the four Ingersoll-Rand HHE compressors shown above. The plant's output is used largely as fertilizer, although synthetic ammonia is also an important chemical used to make high explosives.

This installation has two trains of compression, each consisting of a four-stage primary compressor and a two-stage booster unit. The primary unit compresses the nitrogen-hydrogen mixture from 9 psi to 3500 psi, dis-

charging to the intake of the booster unit which completes the compression to 15,000 psi.

The application of high-pressure compressors like these has been one of Ingersoll-Rand's major contributions to process industries. For various synthetic-ammonia processes alone I-R has built successful high-pressure compressors totalling more than 170,000 horsepower. Eight of them were for 15,000 psi; the remainder for pressures from 3,000 to 5,000 psi. The first units are still in operation after 27 years of service at 4500 psi.

If you have a process-compressor problem, your I-R representative is well qualified to give you expert assistance, no matter what the gas, pressure, or process.

COMPRESSORS • AIR TOOLS • ROCK DRILLS • TURBO BLOWERS
CONDENSERS • CENTRIFUGAL PUMPS • DIESEL & GAS ENGINES



## News about flexible metal connectors



HERE THEY CARRY SATURATED STEAM. At The Firestone Tire & Rubber Company, these giant molds cure two tires at once. American Flexible Seamless Bronze Tubing conveys the saturated steam. In opening and closing, the mold lids move in three planes. Firestone found this tubing gives the flexibility required. Non-flexible connections sprang leaks from alternating hot-to-cold temperatures. Now American Flexible Metal Tubing is

used on molds of this type in all plants of the Firestone Tire & Rubber Company. "Saves power, cuts repairs," say their engineers.

If connections on your product must move, bend, vibrate or resist heat, cold or pressure, American has a flexible metal hose to save on assembly time and avoid maintenance troubles. It can also carry corrosive liquids, gases or semisolids.

WRITE FOR BOOKLET SS-50—shows how the tubing is designed, used and installed; gives specifications on tubing and fittings. The American Brass Company, American Metal Hose Branch, Waterbury 20, Connecticut. In Canada: The Canadian Fairbanks-Morse Company, Limited.

wherever connectors must move... American flexible metal hose and tubing



### **Solvay Technical Service**

is

DIFFERENT

What business are you in-glass?... paper?... textiles? No matter what industry you are engaged in, it's important for you to know about this different type of technical service.

The staff members of SOLVAY TECHNICAL SERVICE are field experts who have spent their entire careers specializing in individual industries; they are thoroughly versed in alkali chemistry and its uses in these industries. When you call on SOLVAY TECHNICAL SERVICE for assistance, you can be sure that you will get the services of a man who knows your industry... its methods... its problems.

There's no charge of obligation for the services of these "individual industry" specialists For further information, write in confidence to the nearest SOLVAY office.

SOLVAY PROCESS DIVISION

ALLIED CHEMICAL & DYE CORPORATION 61 Brogdway, New York 6, N. Y.

Boston • Charlotte • Chipógo • Cincinnati • Cleveland • Detroit • Houston New Orleans • Riew Yers • Philadelphia • Pittsburgh • St. Louis • Syracus



Soda Asn
Caustic Soda
Caustic Potash
Chlorine
Potassium Carbonate
Calcium Chloride
Sodium Bicarbonate
Specialty Cleansers
Sodium Nitrite
Ammonium Bicarbonate
Para-dichlorobenzene
Ortho-dichlorobenzene
Ammonium Chloride

#### TECHNICAL LITERATURE AVAILABLE

SOLVAY Technical Bulletins are authentic, reliable sources of information that are used by many operating plants and research laboratories throughout the country. They are available to industrial and educational institutions in the U. S. and Canada only on request, without obligation.

#### BULLETIN

No. 5-Soda Ash

No. 6-Caustic Soda

No. 7-Liquid Chlorine

No. 8-Alkalies and Chlorine in the Treatment of Municipal and Industrial Water No. 9-Analysis of Alkalies

No. 11-Water Analysis

No. 12-The Analysis of Liquid Chlorine and Bleach

No. 14-Chlorine Bleach Solutions

No. 16-Calcium Chloride



#### PLAN TOMORROW'S CHARGING ROOM TODAY!

This free 20-page booklet showing efficient, charging room layouts is just what you need to put system into your battery charging operations. It's the latest addition to the vast fund of technical information available to you under the Gould Plus-Performance Plan. Shows how cranes, hoists, battery stands, charging equipment and stations can be located in any size room for maximum efficiency, handling speed and safety. You'll need it tomorrow ... so send for it TODAY.





You may be able to save up to 50% on your industrial truck battery costs by using the Gould Plus-Performance Plan. Write Gould Battery Information Headquarters for full information.

Industrial Batteries GOULD-NATIONAL BATTERIES, INC., TRENTON 7, N. J.

Always Use Gould-National Automobile and Truck Batteries

### ORLON PAYS 8-TO-1 IN ACID TEST

Both of these uniforms were worn in a battery plant where they were constantly exposed to sulfuric acid. One was worn for four months; the other for just two weeks. But the one that looks like new—without a single acid hole in it—is the one that was worn eight times longer. The reason is that this uniform is made of acid-resistant "Orlon," Du Pont's acrylic fiber.

Reading Batteries, Inc., of Reading, Pennsylvania, the company that tested these work clothes, reports that the uniform of "Orlon" is good for at least a year more of service. The company is now making a complete changeover to work clothes of "Orlon."

Your business, too, may benefit from the unique combination of properties found in "Orlon." Work clothes of "Orlon" improve worker appearance—besides giving longer service at lower cost under deteriorating chemical conditions. The weatherresistance, wrinkle-resistance and easylaunderability properties of "Orlon" are extending their usefulness in industry. Well-tailored fabrics of "Orlon" make handsome but durable uniforms for service-station attendants, conductors, plant guards and policemen. And the usefulness of "Orlon" extends far beyond work clothing and service uniforms. The fiber is being used in pneumatic filtration bags, hydraulic press cloths and awning materials, too.

"Orlon" resists the damaging effect of heat and sunlight, as well as of acids; it has high strength, wet or dry; and good abrasion- and stretch-resistance. Perhaps "Orlon" can help you in your business. Write E. I. du Pont de Nemours & Co. (Inc.), Textile Fibers Dept., Room N-2504-C, Wilmington 98, Delaware.

"Orlon" is Du Pont's trade-mark for its acrylic fiber.

Many manufacturers make fabrics of "Orlon" acrylic fiber . . . made and supplied to them by Du Pont. Look for its extra values in more and more products for industry.



0500 Anniversory

BETTER THINGS FOR BETTER LIVING . . . THROUGH CHEMISTRY

## NOW...New Carboloy for resistance to corrosion,



#### PROPERTIES OF GRADE 608

The outstanding properties of Grade 608 Cemented Chrome Carbide promise to open new cost-saving applications throughout industry. You may wish to expedite your initial test appraisals by starting with the test kit (above coupon) now pending larger quantities or supplies as production facilities expand.

#### PHYSICAL PROPERTIES

(Grade 608)

Composition: 83% Cr<sub>3</sub> C<sub>2</sub> WC

15% Ni

Hardness (Nominal): 88 Rockwell "A"

Density (Nominal): 7.0 gms/cm3 (Slightly lighter than S.A.E. 1095 steel)

Transverse Rupture Strength: 100,000 P.S.I.

Coefficient of Thermal Expansion:  $6.4 \times 10^{-6}$  in range of  $70^{\circ}$ — $1292^{\circ}F$ .

Relative Abrasive Resistance: Dry Al Oxide-58.0



GAGE ANVILS currently being made of Grade 608 Chrome Carbide. In gage blocks, ring gages, plug gages and gage anvils. Chrome Carbide has al-ready shown an outstanding ability to resist corrosion and abrasion. Since its coefficient of thermal expansion is about the same as that of steel, readings are not affected by temperature variations.



MICROSTRUCTURE of Carboloy Grade 608 Chrome Carbide shows appearance unlike any other metal. Note, particularly, the uniformity and interlocking character of the grain structure. Chrome Carbide is lighter in weight than tungsten carbide; facilitates handling and use of solid carbide. It will pay to start your laboratory tests on Chrome Carbides now.

# Chrome Carbide abrasion, erosion

Grade 608 Carboloy Cemented Chrome Carbide, with chromium as principal ingredient, gives high resistance to corrosion or erosion, combined with good abrasion resistance. Lightweight, nonmagnetic, machineable, stable and strong, Grade 608 opens to you new areas for carbide benefits in industrial and product applications. Sample test quantities now available at nominal cost. Production quantities soon.

NOW, another great Carboloy created-metal makes its bow . . . Carboloy Grade 608 Cemented Chrome Carbide, first in an entirely new series of metallic carbides.

Grade 608 Chrome Carbide contains chromium as the principal ingredient. It is cobalt-free and practically tungsten-free. It features high resistance to corrosion or erosion, combined with good abrasion resistance.

Field tests already point up exciting new areas where Chrome Carbide will bring new cuts in costs, new highs in performance. Undoubtedly, your field, your product may benefit, too. Send for test kit to start your preliminary metallurgical and chemical test of Grade 608 today.

#### An expansion of carbides

Grade 608 Chrome Carbide is light in weight, completely nonmagnetic and has a coefficient of thermal expansion about the same as that of steel. It is machineable and as hard as tungsten carbide. It is stable and strong.

Fabricating and finishing techniques are the same as tungsten carbides. A flash plating of nickel makes Chrome Carbide blanks (as sintered or as ground) readily brazable with conventional brazing materials.

Series 600 may overlap a few tungsten carbide applications. But because of their unusual wearproofing properties, their wear-and corrosion-resistance, look to Chrome Carbides for famous carbide benefits to you in many new areas of industrial and product applications. Here may be new opportunities for you, starting with Grade 608.

## CARBOLOY DEPARTMENT OF GENERAL ELECTRIC COMPANY Doiroft 32, Michigan

"Carboloy" is the trademark for the products of Carboloy
Department of General Electric Company

#### WHERE CAN YOU USE GRADE 608 CHROME CARBIDE?

Field tests indicate new Grade 608 Chrome Carbide offers unusually high resistance to corrosion or erosion combined with good abrasion resistance. For example, the following applications are suggested:

Sheer blades for moiten glass Core pins for baking ceramic parts Fishing rad guides

Centrifuge nozzles, separating equipment

Bearings where corrosives are present
Textile guides Nazzles and valves: soaps, fats, oils, foods, chemicals, petroleum products, pharmaceuticals, fruit juices

Valve and core pins, die cesting Punches for movie film For many applications where stain-

less steel is not sufficiently abrasion-resistant

Where else can you use Grade 608 Chrome Carbide?

#### 9-piece Test Kit \$1025



INCLUDES: Three bars ¼" square x 2"; two bars ¾" square x 1"; three bushings 5/16" long, ½" O.D., 5/16" I.D.; one rod ¾" diameter x 1" long. (Bulletin WR-104 included.) Samples adequate for wide range of tests. Information relative to your particular application free, on request from Carboloy engineers. Send coupon below today for test kit.

11125 East 8 Mil		eral Electric Company t 32, Michigan
Please send free	copy of Technic	cal Bulletin WR-104 only
Please send ( ) test k at \$10.75 each. Techni		rboloy Cemented Chrome Carbid.
		T 2 1 0 - 1 - 1 - 0
Enclosed is Check Please invoice us.	☐ Money Order	Purchase Order for \$



## these fatalities — look for it in the belts you buy

Press overlaps, inherent in belts cured by flat press methods, are a primary cause of early belt failure. The overlaps result in overcured segments 2" to 4" wide across the entire belt because vulcanization is not continuous. These 2" to 4" segments are double cured — and double curing weakens the

When you buy a BWH conveyor belt made by the continuous ROTOCURE process of vulcanization you obtain a uniformly strong belt overall. The weakened segments due to overlapping that sabotage operations and inflate belting costs are completely eliminated. With continuous, endless vulcanization you'll be ahead four ways:

- In increased belt flex life as much as 40%
   In elimination of mechanical distortion at the
- press ends

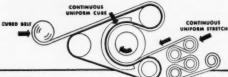
3. In constant, uniform stretch

4. In uniform, abrasion-resistant covers

These characteristics of BWH Conveyor Belts mean minimum belt maintenance costs, longer belt life and appreciable per ton savings in the cost of what you convey! Ask your BWH distributor to show you how these highly serviceable belts can help you. Or write us direct.\*\*

\*\*Ask him also about BWH Rotocured Transmission Belts. Because they permit operation at lower tensions, you are assured of longest possible bel life.

DIAGRAMMATIC SKETCH OF EXCLUSIVE ROTOCURE PROCESS





Another Quality Product of

#### OSTON WOVEN HOSE & RUBBER COMPANY

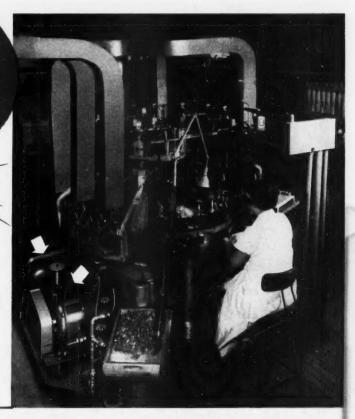
Distributors in all Principal Cities

PLANT, CAMBRIDGE, MASS. . P.O. BOX 1071, BOSTON 3, MASS., U. S. A. WAREHOUSE STOCK, 111 NORTH CANAL ST., CHICAGO, ILLINOIS

Western
Electric
helps
ring the bell



KINNEY
HIGH VACUUM
PUMPS



Electronic tubes for rural telephone circuits make two trips around this rotary sealing machine before they take the big trip to the country. First, the tubes receive their glass envelopes, after which they are evacuated and sealed under ultra-high vacuum . . . created by Kinney Vacuum Pumps.

To insure proper operation and long tube life, every trace of oxygen must be exhausted from the tubes before sealing. Kinney Vacuum Pumps are used in this and thousands of other automatic exhaust machines throughout the world. They combine these all-important features: fast recovery speed, low ultimate pressures,

and complete dependability.

There's a Kinney Pump for every vacuum requirement—whether you're working to 1 mm. Hg., ten microns, or a tenth of a micron—from the new giant 1600 cu. ft. per min. model to the midget Model CVM 3153 with a free air displacement of only 2 cu. ft. per min.

Send coupon today for complete details. KINNEY MANUFACTURING CO., Boston 30, Mass. Representatives in New York, Chicago, Cleveland, Philadelphia, Houston, New Orleans, Los Angeles, San Francisco, Seattle.

FOREIGN REPRESENTATIVES: Gen'l Engineering Co., Ltd., Radcliffe, Lancs., England \* Horrocks, Roxburgh Pty., Ltd., Melbourne, C.I. Australia \* W. S. Thomas & Taylor Pty., Ltd., Johannesburg, South Africa \* Novelectric, Ltd., Zurich, Switzerland \* C.I.R.E. Piazza Cavour 25, Rome, Italy.



KINNEY	MANUFACTURING	co.
3551 W	ASHINGTON ST.,	
BALTAN	20 11455	

Please send new Bulletin V-51B. Our vacuum problem involves:

- Vacuum exhausting
  - exhausting d
- Vacuum coating
- vacuum distillation
- Vacuum metallurgy
  Vacuum

Name
Company
A

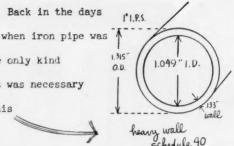
Address

City



Back in the days

virtually the only kind available, it was necessary to specify this



But today with the high strength/weight ratio of stainless steel, the great majority of pipeline and

have an ample margin of

safety with this

1.315" 1.185 process applications will 065 light wall

## Why pay for Schedule 40 pipe where Schedule 5 is more than adequate?

All sizes of Carpenter Schedule 5 pipe will easily handle 150 psi working pressures. Sizes under 1½" will safely handle considerably higher pressures.

By specifying this light wall stainless pipe you gain many advantages:

- 1. You save money. Schedule 5 pipe costs about half as much per foot as Schedule 40.
- Schedule 5 has the same O.D. as Schedules 10, 40 and 80-for hook-up with existing lines as well as for new installations.
- 3. Its larger I.D. increases flow and capacity in pipelines, exchangers and other equipment.
- 4. It's lighter. This means quicker and easier installation.

- 5. You can save 10% to 25% on valves, fittings, weld rods, etc., because smaller O.D. material can frequently be used.
- 6. Fittings are available from several manufacturers ... and stocks of Schedule 5 pipe are carried by conveniently located Carpenter distributors.
- 7. Tubing sizes can now be replaced with light wall pipe . . . for ready hook-up with standard valves, pumps, etc.

Light wall Schedule 5 pipe saves dollars-and makes a lot of sense!

For complete data on Carpenter Schedule 5 Stainless Pipe, call your nearest Carpenter distributor or write us direct. We'll be glad to send you the information you need. THE CARPENTER STEEL COMPANY, Alloy Tube Division, Union, N. J.

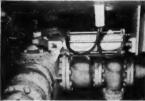
Export Dept.: The Carpenter Steel Co., Port Washington, N.Y. "CARSTEELCO"

HEEDS YOUR arpenter

guaranteed on every shipment



### IN SEWAGE PLANTS, these electrically-timed, fully-automatic, air-cylinder operated Q.C.£ Valves shear obstructions.



IN CHEMICAL PLANTS air-operated Q.C.E. Valves offer super-dependability...self protected from abrasive and corrosive action.



EN THE STEEL INDUSTRY Q.C.F. Valves provide split-second control of fuel oil and gas to furnaces and coke ovens.

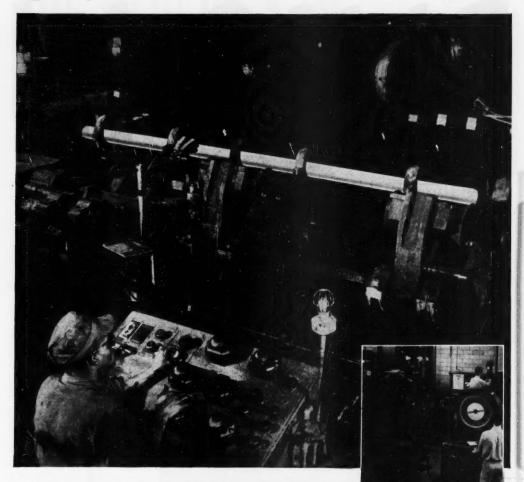
## SPLIT SECOND ROBOT CONTROL

Q.C.£ CYLINDRICAL Plug Valves are ideal for all types of automatic operation: hydraulic, electrical, or air operated. The quick quarter-turn from full-open to full-closed is always sure as there's no wedge effect to cause jamming in the seat. In addition, all bearing surfaces are lubricated for easy turning. Sound reasons to insist on Q.C.£ Plug Valves for all automatic valve operations.





## Specify GLOBE for the finest steel tubes



## Specialized research, engineering and production assure uniform high-quality STEEL TUBES

A<sup>T</sup> Globe, specialization is the keynote. Men, machines, and raw materials are all tailored to fit the Globe specialized process. Precision checks — and rechecks — at every stage of production insure Globe Tubes that meet your exacting specifications.

Be sure! Specify dependable, high-quality Globe Steel Tubes and be certain of getting the finest tubes available. Write for the General Catalog and become acquainted with Globe *specialized* process.

#### GLOBE STEEL TUBES CO., Milwaukee 46, Wisconsin

Chicago • Cleveland • Detroit • New York • Houston • St. Louis Denver • San Francisco • Glendale, Cal, • Philadelphia

Globe's Physical Testing Laboratory
— one of the seven different research
and testing labs in Globe's House of
Science.

#### GLOBE STEEL TUBES ARE AVAILABLE IN:

 Steinless Steels — Globe seamless ° High Purity Iron — Globeiron ° Steinless Steels Gloweld Welded ° Corrosion Resistant Steels ° Alloy Steels ° Carbon Steel ° High-Temperature Service Steels ° Standard and Special Analysis Steels ° Machanical and Pressure Unbing

The plug-in controllers can be removed and replaced with another unit in just 10 seconds.

One common, self-sealing manifold gives plug-in connections to both receivers and controllers!

> Rugged steel sleeve clamps on panel, without welding or drilling. Completely protects recorder mechanism.

The only piping on the panel back are lines from the transmitter, air supply and controller output. Units can be mounted just a few inches apart.

Recorder or indicator plugs in from the front—units can be interchanged in just 10 seconds.

# THE NEW IDEA IN PANEL INSTRUMENTATION

Taylor, pioneer in the 3-part control system brings many new refinements based on extensive field experience

- 1. Change from simplest to most complex control by simply pulling out one unit, plugging in another.
- 2. Change from indicator to recorder or vice versa in only 10 seconds.
- 3. One mounting for both controller and receiver—recorder or indicator.
- Recorders or indicators can be mounted on the panel without welding, without drilling holes.
- 5. Only piping connections required are air supply, controller output, and to variable transmitter. All other connections made automatically in self-sealing manifold.
- All adjustments can be reached without disturbing any connections.
- 7. Mountings are extremely simple and rugged.

- 8. You save panel space by mounting units a few inches apart.
- 9. Receiver mechanism totally enclosed by protective sleeve.
- 10. You save money on installation thanks to simplified piping and mounting.

Be sure to get information on the new and greater plug-in type Taylor TRANSET Control before you make any decision involving pneumatic transmission control. Taylor Instrument Companies, Rochester, N. Y., and Toronto, Canada.

Instruments for indicating, recording and controlling temperature, pressure, flow, liquid level, speed, density, load and bumidity.

& Reg. U. S. Pat. Off.

## ADDITIONAL NEW FEATURES IN TAYLOR'S TRANSET® RECORDER:

Continuous valve position indication on separate scale tells valve pressure at a glance.

Chart read back device gives easy access to past records without disturbing any function of the recorder or interrupting the record.

New chart drive mechanism for greater convenience, greater dependability.

Taylor Instruments

ACCURACY FIRST

IN HOME AND INDUSTRY

## OLIVER FILTER **Variation** ...doing exceptionally well on two difficult

The jobs are difficult because the cakes are thin and sticky and almost impossible to discharge from a standard wire-wound drum type filter.

Oliver Precoat Filter

With the Oliver Precoat Filter, the solids form on the surface of a predeposited thick cake of permeable filter aid rather than on the cover itself. This cake, along with a very thin film of filter aid, is shaved off continuously by a slow in-traveling knife edge discharger which leaves a clean surface at all times for cake deposition. Flow rates stay high.

The Oliver Panel Filter is handling its job effectively because of its special discharge cross-wires set at the proper angles and tension. These wires lift the cake off 'clean as a whistle.' On the Panel Filter there is no wire winding to hold the cover in place. It's placed over two or three panels and calked into grooves. Flow rates stay high.

The Oliver Precoat and Panel Filters are but two of the many types we manufacture for the three broad divisions of filtration-continuous vacuum, continuous pressure and batch pressure. Thus, we are in position to select from many the best type and size for your problem. And to this problem we would bring 45 years of filtration experience gained in serving every division of the process industry.

> New York 36 - 33 W. 42nd \$1. Oakland 1 - 2900 Glascock St.

Export Sales Office - New York

Chicago 1 - 221 N, LaSalle St. San Francisco 11 - 260 Calif. St. Cable - OLIUNIFILT



filtration jobs

## FACTORIES: Hozleton Po

#### WORLD WIDE SALES, SERVICE AND MANUFACTURING FACILITIES

CANADA

E. Long, Ltd. Orillia, Ontario

MEXICO & CENT. AMERICA Oliver United Filters Inc.

Oakland, Calif.

Perr-Oliver (India) Ltd., Sombay

EUROPE & NORTH AFRICA

Dorr-Oliver S. A. Brussels

Dorr-Oliver S.N.a.R.L. Paris

Dorr g.m.b.h. Wiesbeden (16)

Dorr-Oliver Co., Ltd., London, S.W. 1

Dorr-Oliver S.a.R.L. Milano Dorr-Oliver, N.V. Amsterdam-C PHILIPPINE ISLANDS E. J. Nell Co.

HAWAIIAN ISLANDS

A. R. Duvoli Honolulu

WEST INDIES Wm. A. Powe - Havang SOUTH AMERICA & ASIA The Dorr Co.

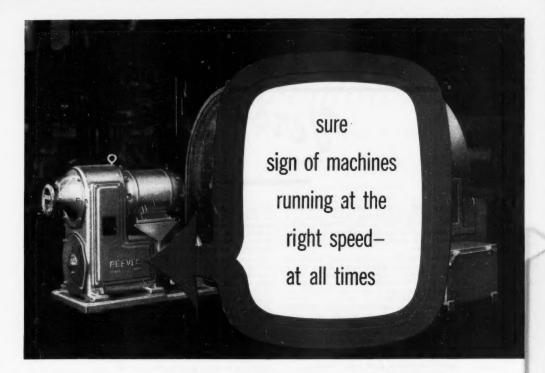
Stamford, Conn. AUSTRALIA

Hobart Duff Pty., Ltd. .

Melbourne

SOUTH AFRICA

E. L. Bateman Pty., Ltd. Johannesburg, Transvaal

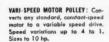


## Reeves Variable Speed Drives

Reeves makes America's only complete line of variable speed drives -not 1, but 3 types to choose from



▼ARIABLE SPEED TRANSMISSION: Provides stepless speed adjustability over a wide range—as high as 16 to 1; sixes to 87 hp. Vertical or horizontal designs—open or en-







VARI-SPEED MOTODRIVE®: A complete variable speed power plant. Combines any standard, constant-speed motor, REEVES speed-changing mechanism and gear reducer in one, compact unit. Sizes to 25 hp; speed ratios as great as 10 to 1.

Machines equipped with Reeves Variable Speed Drives . . . have a wider work range, handle more different shapes, sizes, and materials . . . because Reeves always provides the accurate, infinitely variable speed adjustability that is the key to efficient production.

With the turn of a handwheel, touch of a button, or automatically—without stopping the machine—you can change the speed to meet the need of every operation, every operator, and every operating condition. The result is higher rate of production and improved, uniform quality—at lower cost.

For machines now in service and the new ones you plan to buy, standardize on Reeves. Proved in 300,000 successful installations . . . available to you in a wider range of designs, sizes, speed ratios, and controls than any other make of variable speed drives. Send for free catalog No. CE81-G.

REEVES PULLEY COMPANY . COLUMBUS, INDIANA

Recognized leader in the specialized field of variable speed control

REEVES Control

# TYGON

# Versus H. CrO.

HROMIC ACID is useful, but destructive. Its highly oxidizing nature makes it a valuable tool to the chemist and the engineer. This same characteristic, however, makes it a costly tool from the standpoint of corrosion.

Combatting the corrosive attack of chromic acid is a tough problem—a problem that is not completely answered by even the versatile TYGON family of plastic compounds. However, through proper use, TYGON can and does offer effective, economical protection against chromic acid in many instances.

The TYGON family consists of a series of modified polyvinyl resins skillfully compounded to give the maximum in general chemical resistance and physical characteristics. These compounds take the form of calendered or press-polished sheeting, molded goods, extrusions, paint and plastisols.

TYGON sheeting is made in thicknesses ranging from 1/64" to 1/2" and in continuous lengths or sheet form depending upon thickness. The main use for TYGON sheeting is in the lining and covering of such equipment as tanks, tank covers, diffusional towers, vats, bins, hoppers, troughs, blowers, impellers, fume hoods, and fume ducts. It is also die-cut into gaskets for positive seals in all types of processing equipment.

all types of processing equipment.

As sheeting, TYGON resists chromic acid in concentrations up to 30% and at temperatures up to 130°F. At room temperature, the concentration limit may be raised to 50%. If a mixture of chromic and sulfuric acids is used, the maximum concentration should be 15-20% at 130°F. Against a hard chrome plating solution, TYGON should be used with a protective sheathing of acid resistant brick and cement. Such a sheathing also permits the use of TYGON against other solutions of chromic acid at service limits considerably above those for an unprotected lining. Higher service limits are also possible when TYGON is used as gasketing, since only a small portion of the gasket is usually exposed.

In contact with chromic acid, TYGON undergoes some physical changes. Prolonged exposure causes surface hardening and a noticeable color change. However, these changes do not affect TYGON's protectability.

As molded goods, TYGON has many uses — uses limited only by the size and shape that

can be imparted to a thermoplastic material by mold and press. When molded, TYGON exhibits the same resistance to chromic acid as it does in sheet form. In some cases, higher service limits are possible depending upon the size, design, and use of the molded item.

size, design, and use of the motion term.

A major use of TYGON is as extruded tubing and piping. The full flexibility, glasslike clarity, lightweight, smooth surface, and high strength of TYGON tubing has done much to simplify many piping jobs in the laboratory and the plant. Extruded solid cord and channel also find use as gasketing, expansion jointing and packing.

In extruded form, TYGON also resists chromic acid in concentrations up to 30% and at temperatures up to 130°F. At room temperature, the concentration limit may be raised to 50%. Against mixtures of acids, service limits should be lowered to a maximum of 20% at 130°F. On prolonged exposure to chromic acid the tubing tends to stiffen, harden and discolor. However, the resistance and functioning of the tubing is not affected. Because of the staining that results, clear TYGON tubing is not recommended for use with chromic acid.

TYGON, as a paint, protects all types of equipment, structural steel, walls, and ceilings against the fumes and spillage of chromic acid. Special consideration should be given to the physical limits of a thin film. TYGON paint should not be used as a lining material. In all exposures to chromic acid, a minimum system of a primer plus five top coats of TYGON paint is recommended.

Properly applied, TYGON paint resists the fumes and spillage of chromic acid in any concentration and up to 200°F. Spillage should be washed away as soon as possible. Some staining from spill is to be expected.

As a plastisol (TYGOFLEX), TYGON finds use as a heavier duty coating and in the casting or "slush" molding of flexible parts and fittings. In this form, the resistance to chromic acid depends somewhat upon the thickness of the coating deposited, but approximates the resistance of TYGON sheeting.

Although its use against chromic acid is more limited than it is against other chemicals, properly applied TYGON provides low cost protection and a high degree of safety in handling this acid and related chemicals.



In addition to TYGON in its various forms, we also manufacture a number of other materials capable of bandling chromic acid in any concentration and under all types of operating conditions. These products include chemical stoneurare and porcelain, acid proof brick and cements, homogenous lead linings, and other organic linings and coatings.

Wby don't you submit your corrosion problem today? There's no obligation and we'll be pleased to be of assistance. So write, now!

THE UNITED STATES STONEWARE CO., Akron 9, Ohio

ENGINEERS, MANUFACTURERS, ERECTORS OF CORROSION-RESISTANT EQUIPMENT SINCE 1865

# THE Chementator

Prepared under the editorial direction of Joseph A. O'Connor, News Editor

#### New ammonia producer for West Coast?

A new outfit, the Ammonia Chemical Corp. of California, is seeking incorporation in Sacramento. It will be capitalized at 500,000 shares, authorized at \$10 a share. Primary business: to manufacture, distribute and sell anhydrous ammonia and related chemical products.

Costs on a plant to produce 100 tons of ammonia per day are being estimated. It would be erected in California. Principal backer of the new venture is John H. Finney.

The newcomer got little encouragement from DPA when it sounded out that agency on the possible need for increased ammonia capacity on the West Coast. DPA pointed out that four plants already authorized there would take care of goals set through 1953. The four plants apparently are the Shell ammonia plant at Ventura, Calif.; Union Oil's proposed plant in Southern California; Hooker's ammonia expansion at Tacoma, Wash.; and Pacific Chemical's plant in Washington. Hercules has also been exploring the possibilities of expanding ammonia production on the West Coast.

#### Jet take-off for titanium

More titanium is urgently needed, and its production cannot be held up until improved processes are developed. That's why the government has made agreements with Du Pont and Titanium Metals Corp. of America for increased output.

Defense Materials Procurement Agency has contracted with Du Pont for the additional production of 13,500 short tons of titanium sponge during the next five years. The government will advance the company up to \$14.7 million to triple capacity of its Newport and Edge Moor, Del., plants.

The money will be paid back with interest once the new facilities begin producing titanium sponge for sale. But if improved methods for production of titanium are found during the life of the contract, much of the new facilities might become obsolete.

Then, according to Jess Larson, administrator of DMPA, "the government would take possession of the obsolescent facilities and would waive repayment of their original cost, less depreciation and amortization." Du Pont has asked NPA for a fast tax writeoff on 90 percent of the project.

The agreement with Du Pont is similar to one the

government has with Titanium Metals. It calls for production at Henderson, Nev., of 18,000 tons of titanium sponge over a five-year period.

Big stumbling block to greater use of titanium is its current high price. Sponge metal costs about \$5 a lb., and mill products sell for about \$15 a lb. About 95 per cent of all production goes into aircraft, and defense needs are mounting.

Titanium production will hit 2,000 tons this year, about 4,000 tons in 1953, and climb to at least 8,000 tons or better by 1955. In fact, DPA has set an expansion goal for titanium sponge of 10,000 tons by 1955 or sooner. This compares with about 500 short tons in 1951, the second year of commercial production.

#### How higher taxes hit chemical makers

How the bigger corporate tax bite affects the cost of chemical manufacturing shows up in a breakdown by Du Pont of its 1951 operations.

Du Pont's direct liability for taxes and renegotiation last year came to \$383 million on its gross operating income of \$1,546,000,000. In addition, about 80,000 workers whose pay came from that income had about \$46 million withheld for taxes from their salaries and wages.

Du Pont's taxes were nearly triple the \$135 million the company spent to build new plants and to expand existing ones. The tax collector even did better than the company's owners; he took \$4.25 for each dollar paid out in dividends.

For many products and many companies, President Crawford H. Greenewalt of Du Pont admits, higher corporate taxes have been offset by economies resulting from new technologies. But, he adds. in such instances taxes siphoned off the cost reductions that would otherwise have been passed on to the public as lower prices.

#### Another diffusion plant for AEC

The U.S. Atomic Energy Commission will construct a new gaseous diffusion plant in southern Ohio for production of uranium 235. The plant will be located in Pike County about 22 mi. north of Portsmouth. About 6.500 acres will be acquired. Abundant water and the potential availability of power at reasonable cost were important factors in selecting the site.

The plant will separate fissionable uranium 235 from non-fissionable uranium 238 by the gaseous diffu-

sion process. Uranium hexafluoride gas will be pumped through thousands of extremely fine barriers with millions of tiny holes per square inch. Since the lighter U-235 atoms travel slightly faster, they strike the screens and pass through the holes more often than the U-238 atoms. This process gradually separates the U-235 atoms.

It will take four years to build the \$1.2 billion plant, although parts of it will be operating sooner. Eventually the plant will employ about 4,000.

This plant is the only wholly new one included in the \$3 billion atomic expansion program for which Congress appropriated money before it adjourned. With other phases of the expansion program, it will bring U.S. plant investment in atomic facilities to more than \$6 billion for construction alone.

Oak Ridge gets about \$464 million, and \$459 million goes to the Paducah, Ky., plant. Both are gaseous diffusion operations.

The Savannah River, S. C., project, which will almost surely attempt to produce the heavy-hydrogen isotope tritium for an H-bomb, as well as fissionable fuel for conventional A-bombs, gets an added \$171 million. And to Hanford, Wash., where plutonium is produced, goes \$411 million.

Goal of the expansion, as explained by AEC Chairman Gordon Dean when the appropriation was up in Congress, is to achieve the minimum stockpile objective called for by top defense planners, and to achieve it about five years sooner than it could be reached without the expansion.

At capacity, the new \$1.2 billion diffusion plant in Ohio will require about 1.8 million kilowatts of power. AEC has been negotiating with 15 utility companies in the Ohio Valley. New power plants will have to be built.

#### New ceramics for high temperatures

Carborundum Co. has developed an important new ceramic material that is being successfully used to withstand extremely high temperatures and pressures. Currently it is being used for lining rocket motor assemblies and for nozzles in new rocket type artillery ammunition.

Products of the same general type will have important uses as materials of construction in the petroleum industry and in other chemical process industries.

Called Niafrax, these ceramic materials are a special type of silicon carbide bonded with silicon nitride. Niafrax refractories bridge the gap between regular ceramics and alloys. They can be substituted for expensive alloys containing such critical metals as cobalt, columbium and nickel in parts of jet engine power plants, guided missiles and rockets.

For the short durations involved in rocket motors, Niafrax refractories have withstood temperatures higher than 5,000 deg. F. and pressures of 300 psi. and greater. They withstand heat shock and dissipate heat very rapidly.

Although not readily machineable, Niafrax shapes can be molded to tolerances as close as plus or minus 0.005 in., being somewhat comparable to metals in this respect. These refractories withstand scouring action caused by impingement of gas or airborne particles on the ceramic.

In rocket motors, Niafrax nozzles range from ¼ in. to 10 in. in throat size. Plain cylinders of the new ceramic are used to line rocket combustion chambers. These chambers and nozzles go into rocket motors of uncooled design, replacing more expensive regeneratively cooled alloy assemblies. According to Carborundum, Niafrax refractories are the only ceramic materials commercially available and used to any extent in components for rocket motors.

Compositions similar to Niafrax refractories will have important applications in chemical processing for high-temperature high-pressure conditions. Major oil companies are approaching pilot-plant scale with new equipment using these refractories and expect to revolutionize oil and gas cracking operations.

In one experimental design, oil is sprayed into the throat of a venturi and cracked by hot gases flowing through the nozzle from a combustion chamber. Other jobs for the new ceramics in the chemical process industries will come where temperatures exceed those readily handled by alloys or where an increase in the process temperature with correspondingly higher yield would be economical.

#### New way to make dicalcium phosphate

NEW PLANT—At a cost close to \$7 million, Texas City Chemicals, Inc., will build and operate a plant at Texas City, Tex., that will produce more than 70,000 tons a year of dicalcium phosphate by treating phosphate rock with spent sulphuric acid. As a byproduct of the process, uranium will be recovered and sold to the AEC.

Eighty percent of the dicalcium phosphate produced will be marketed as animal feed supplement, and 20 percent will be of fertilizer grade. Sodium silicofluoride for water fluoridation will also be produced.

Chemical Construction Corp. will design the plant and construct it at a cost over \$5 million. DPA has granted a fast tax writeoff on \$3,005,250 of the plant's cost. It will be ready to operate by August 1953.

NEW PROCESS—The dicalcium phosphate plant will embody new combinations for processing phosphate rock. The process was developed by W. R. Seyfried of Chemico.

Dicalcium phosphate will be produced by a sulphuric acid extraction or wet process, using spent sulphuric instead of concentrated acid. Finely ground phosphate rock is mixed with spent sulphuric acid to (Continued on page 108)

September 1952—CHEMICAL ENGINEERING

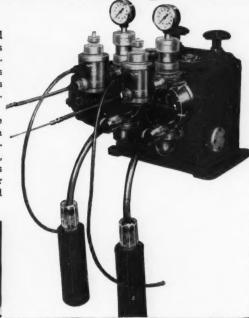
ADDITIVES
INHIBITORS
DYES
SLURRIES
GELLING AGENTS

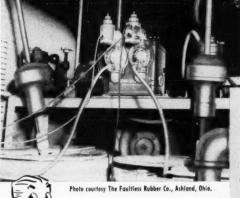
Automatically

in Batch or Continuous Process Operations

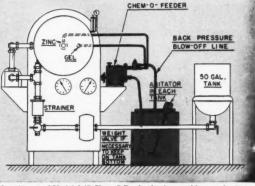
% PROPORTIONEERS, INC. % standard Chem-O-Feeder is particularly adapted to continuous feeding of the "hard-to-handle" reagents and additives. It can be supplied with special heads as illustrated—also special materials – handling heads to accommodate an almost infinite variety of chemical characteristics.

The Chem-O-Feeder is being widely used in the production of foam rubber, the chemical preparation of metal surfaces prior to spray painting, the handling of filter aid slurries in oil recovery operations, and the feeding of dyes in the textile industry. This versatile feeder also has applications in many other industries where difficult, small quantity feeding and proportioning problems are encountered.





Ask... for new, illustrated Bulletin 1225 and recommendations



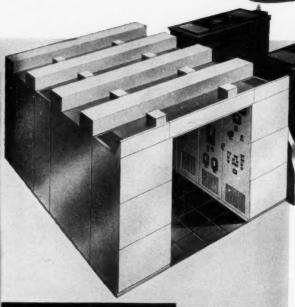
Installation of Model 2-47 Chem-O-Feeder for foam rubber production.

% PROPORTIONEERS, INC. %



Write to %PROPORTIONEERS, INC.%, 389 Harris Ave., Providence 1, R. I.
Technical service representatives in principal cities of the United States. Canada. Mexico and other foreign countries.

## **GET MORE D-C**



I-T-E Mechanical Rectifiers 96% conversion efficiency from a-c line to d-c bus !

#### OPERATING ECONOMY

In processes demanding a heavy, dependable supply of direct current, you can actually save thousands of dollars a year on conversion of a-c to d-c. I-T-E Mechanical Rectifiers convert purchased power with 96% overall efficiency from a-c line to d-c bus. This gives you more d-c for your power dollar.

#### INITIAL SAVINGS

I-T-E Mechanical Rectifiers provide you with an added source of savings. One complete, compact, enclosed Rectifier assembly—transformer, reactor, contact mechanism, overhead bus, d-c switchgear-fits into 120 square feet. No big investment in special building or installation equipment is required.

#### LOW MAINTENANCE

Maintenance is limited to contacts, their operating mechanism, and small auxiliaries. Contact replacement, when necessary, is simple and inexpensive.

#### CAPACITY RANGE

3,000, 4,000, 5,000, 6,000, 7,000, 8,000, 9,000 and 10,000 amperes in any voltage from 50 to 400 volts d-c.

Primary voltages up to 25,000 volts, three phase a-c.

One or more units may be connected in parallel to give any higher d-c current rating.

#### How it works

Take a sine wave



Modify it like this with a \*Permeron-core reactor



Make contact here



Break contact here

Do it 1.296,000 times an hour and get this

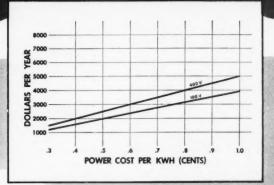


... with a conversion efficiency of 96% or better

\*I-T-E's special saturable core material.

# FROM THE POWER YOU BUY

Save thousands of dollars a year on power costs



This power cost-savings curve, based on figures published by *Chemical Week*, shows you just how much you can save when converting ac with I-T-E Mechanical Rectifiers... If you're using large blocks of power, even a slight improvement in efficiency can save you thousands of dollars a year.

### EXAMPLE:

Suppose you are buying 2000 KW for 24-hour operation, 350 days a year. A 3% gain in power conversion efficiency with the I-T-E Mechanical Rectifier can save you more than \$3500 a year!

# FIGURE IT OUT-

2000 x 24 x 350 = 16,800,000 KWH/year With a 3% improvement in efficiency you save: (16,800,000) (.03) = 504,000 KWH/year

Assuming a nominal industrial rate of 7 mills/KWH: (504,000) (.007) = \$3,528 yearly saving.

Here's how a few percent boost in power conversion efficiency slashed one industrial user's power bills three and a half thousand dollars a year. Check your own power consumption. See how much you can save with the high efficiency I-T-E Mechanical Rectifier.



# SEND FOR DETAILS

New 30-page booklet gives you detailed information on the power-saving 1-T-E Mechanical Rectifier. Illustrated, complete with curves, it tells you the full story about this precision-engineered equipment. Write for your copy of Bulletin 5 106 today.



# MECHANICAL RECTIFIERS

I-T-E CIRCUIT BREAKER COMPANY

Mechanical Rectifier Division

19TH AND HAMILTON STREETS, PHILADELPHIA 30, PENNSYLVANIA

Canadian Mfg. and Sales: Eastern Power Devices, Ltd., Toronto Expart Sales: Philips Expart Corp., N. Y. 17, N. Y. produce phosphoric acid, which is then neutralized with lime to get the dicaleium phosphate.

Part of the spent sulphuric will be used in the dicalcium phosphate process, and part treated with sulphur trioxide in the contact acid unit to produce full-strength sulphuric acid. The contact plant will be of standard design.

RAW MATERIALS—Basic raw materials are spent sulphuric acid, elemental sulphur, phosphate rock, lime and brine.

Under a 15-year contract, Carbide & Carbon will pipe spent acid to the new plant, getting in return 100 to 250 tons per day of concentrated acid from Texas City Chemicals. For each ton of new acid used to upgrade the Carbide acid, Texas City Chemicals will get one ton of weak acid (50 percent minimum) from Carbide for use in the dicalcium phosphate plant.

Carbide will pay \$9 per ton for the first 50 tons a day of fortified acid it gets in return for spent acid; this will decrease to \$3 per ton on deliveries exceeding 250 tons in a day. Texas City Chemicals will also supply additional new acid to Carbide up to 50 tons daily at \$15 per ton.

American Agricultural Chemical Corp. will furnish 100,000 tons a year of Florida phosphate rock for five years starting in July 1953. Base price will be \$4 per ton on a dry basis of 68 percent tribasic calcium phosphate.

NPA has agreed to let Texas City Chemicals use 2,434 net tons per month of sulphur, about 81 percent of the sulphur required for capacity operation. This, together with about 875 tons per month that a sulphur user at a nearby plant has agreed to let Texas City Chemicals have from its allocation, will suffice for planned operations.

MARKETS—Demand for phosphate feed supplements is growing. Present consumption is estimated at 475,000 tons a year as bone meal equivalent. By 1954-1955 requirements could exceed output of present plants by about 125,000 tons.

Production of fertilizer-grade dicalcium phosphate by Texas City Chemicals will be almost insignificant compared with total U.S. consumption of phosphate fertilizers, and the output should be easy to market.

Silicofluorides are being pushed currently for the fluoridation of water, a market that is just opening.

OUTPUT—Each year, the new plant will produce 56,000 tons of dicalcium phosphate for feed supplement and 15,000 tons for fertilizer. It will produce 105,000 net tons of sulphuric acid, and 4,000 tons of sodium silicofluoride.

Uranium, extracted during the manufacture of phosphoric acid by the wet process, will be sold to AEC under a contract that grants the company construction priorities and allocations needed to complete the entire plant.

# Skein of new synthetics

More and more synthetic fibers are being developed. Even though Celanese has called off work on its Fiber 32, a caprolactam-based nylon, spinners are now getting another new Celanese fiber for testing. It's Fiber X-36, a heavy-duty acetate fiber for tire cord and industrial uses.

Tennessee Eastman, meantime, has just about completed development work on its new M-24, a wool-like

Allied Chemical & Dye has been granted a certificate of necessity by the government for a "nylon" plant. But Allied isn't supposed to have gone to Du Pont for a license. Instead, it will produce its fiber by a German process.

Other fibers, including American Cyanamid's X-51, have been developed, but the government is discouraging new fiber plants for all but nylon producers. It's hinted that wool industry opposition to certain new fibers may account, at least in part, for that stand. The government maintains, however, that most of the anticipated military demand is for nylon.

# Sulphur from waste gases

Sulphur dioxide can be recovered from waste gases by scrubbing with aqueous ammonia, report H. F. Johnstone and William E. West, Jr., of the University of Illinois after determining equilibrium vapor pressures of solutions of sulphur dioxide and ammonia in water.

Recovery is efficient, and ammonia loss is not scrious even if the concentration of the original gas is as low as 0.4 percent sulphur dioxide. For dilute gases a modification of the process used by Consolidated Mining & Smelting Co. of Canada, Ltd., at its Trail, B. C., smelter appears to be the most economical.

The proportion of the sulphur dioxide recovered that must be converted into ammonium sulphate can be varied by stripping part of the scrubber offluent before or after partial acidification.

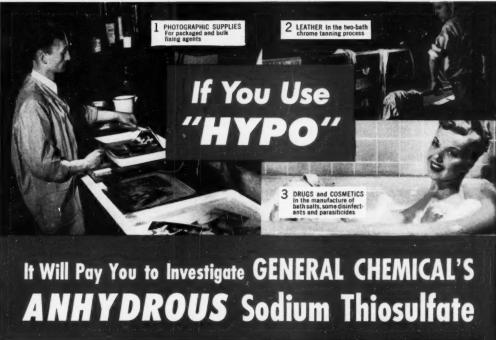
If the value of the ammonium sulphate equals the combined value of the ammonia and sulphuric acid required to produce it, plus the cost of its crystallization from the regenerated solution, it's estimated that the sulphur dioxide can be recovered from 0.4 percent gases at a cost less than the equivalent value of the sulphur.

# Chlorine trifluoride output rises

Pennsylvania Salt Manufacturing Co. has added new facilities at its Natrona, Pa., plant to meet the increasing demand for liquid chlorine trifluoride.

The chemical is made by direct reaction of chlorine and fluorine. Pennsalt, long a basic producer of chlorine, has been manufacturing elemental fluorine for the past year and a half at its Natrona plant.

While chlorine trifluoride is generally comparable (Continued on page 110)



POUND FOR POUND, dollar for dollar, you will find General Chemical's Anhydrous Hypo gives top value in efficiency and economy. It is a sparkling crystalline product that offers many practical advantages in handling, storing and process use. Water-free, it assays 98% Na2S2O3, and does not have the tendency to cake, common to ordinary hydrated "hypo."

It dry-feeds well and dissolves very rapidly in water to give a clear, colorless solution free of harmful impurities. And, if you are a producer of photographic chemicals, you will particularly appreciate the higher density and reduced bulk of General's Anhydrous Hypo, plus its better shelf-life.

GENERAL CHEMICAL'S Anhydrous Sodium Thiosulfate is available for prompt shipment through coast-tocoast distribution points. For further information, call or write the nearest General Chemical office today Trial samples available on request; please use business letterhead when writing.



For bleaching ground wood, straw, fur. In manufacture of organic chemicals. In water treatment

If you prefer hydrated hypo . . use General Chemical's Standard Sodium Thiosulfate

Produced in a wide range of grade sizes suitable for all requirements, it also offers the same superior quality and uniformity for which General Chemical "Hypo" has been known for over half a century



### GENERAL CHEMICAL DIVISION

ALLIED CHEMICAL & DYE CORPORATION

40 Rector Street, New York 6, N. Y.

Offices: Albany • Atlanta • Baltimore • Birmingham • Boston • Bridgeport • Buffalo Charlotte • Chicago • Cleveland • Denvor • Detroit • Greenville (Miss.) • Houston Jacksonville • Kalamazoo • Los Angeles • Minneapolis • New York • Philadelphia Pittsburgh • Providence • St. Louis • San Francisco • Seattle • Yakima (Wash.) In Wisconsin: Ceneral Chemical Company, Inc., Milwaukee, Wis.

ida: The Nichels Chemical Company, Limited • Montreal • Toronto • V

# THE CHEMENTATOR, continued

to elemental fluorine in its reactivity and other characteristics, its rate of reaction is somewhat less, permitting more accurate control in the manufacture of fluorine chemicals.

It can also be more conveniently handled, stored and shipped as a dense liquid. While fluorine must be shipped in cylinders under high pressure, chlorine trifluoride can be shipped as a liquid under pressures of only 10 to 20 psi.

Chlorine trifluoride is expected to be used increasingly as an oxidizing agent in rocket fuels and in the production of high temperatures for cutting metals and siliceous materials, as well as in the manufacture of fluorine and chloro-fluorine chemicals.

# West Coast's first polyethylene plant

First plant on the Pacific Coast to produce polyethylene and ethylene glycol will be built at Torrance, Calif., by Carbide & Carbon.

The \$36 million project, for which DPA has granted certificates of necessity, is being designed to produce from 50 to 60 million pounds of polyethylene and from 5 to 10 million pounds of ethylene glycol a year.

Carbide will erect the plant on a 140-acre site purchased from General Petroleum Corp. The site is adjacent to General Petroleum's refinery at Torrance, and Carbide has signed a 20-year contract with General Petroleum to get raw materials from the refinery.

Already the world's largest producer of polyethylene and ethylene glycol, Carbide built the first polyethylene plant during World War II at the request of the Navy. This plant was the principal source of polyethylene plastics for electrical insulation. When military restrictions were lifted after the war, use of polyethylene increased 10 to 12 times. Industrial demand for this versatile plastic, used in bottles, other containers and wrapping film, as well as in electrical insulation, is mounting. And since mid-1950 it is again needed for defense uses.

Construction of Carbide's new plant in California will give impetus to the growing chemical industry on the Pacific Coast. It will bring polyethylene and ethylene glycol eight to the doorsteps of users on the West Coast and in the Mountain states.

# Continuous process means cheaper Kel-F

Watch for increased output of Kel-F and a possible further reduction in its price. At a cost of about \$1 million, M. W. Kellogg Co. is building new production facilities at its Jersey City, N. J., plant that will lift output of the versatile fluorocarbon plastic close to 1.5 million pounds annually.

A new continuous process will be used in the plant, which will start operating before the end of this year. The process will make possible production in expanded commercial volume to meet increased demand. This, in turn, is expected to lead to another cut in price. The price of Kel-F has been reduced three times since Kellogg first introduced it in 1947.

# More ammonia for Mississippi's farmers

An increase in capacity of its Yazoo City, Miss., ammonia plant is planned by Mississippi Chemical Corp., farmer-controlled organization. Stockholders have authorized an \$8 million expansion.

Owen Cooper, executive vice president, says \$4 million in new stock will be offered. Tax amortization and certificate for materials have already been obtained, and construction starts this fall.

The expansion will double capacity of the plant, which cost \$8 million. Capacity for 120 tons of ammonia and 150 tons of ammonium nitrate will be added. Since the plant began operation in June 1951 it has produced 42,000 tons of ammonium nitrate and 13,000 tons of anhydrous ammonia for fertilizer.

# Tight noose on technical progress

"A noose around the neck of technological progress," is what Chief Engineer Granville M. Read of Du Pont calls the government's excess profits tax.

Read points out that a company that paid \$130,000 in federal taxes in 1930 now pays \$700,000—on a taxable net income of \$1 million. The \$870,000 that would have been available for possible construction expenditures in 1930 has now shriveled to \$300,000 because of the present tax structure.

# Precipitators for sulphate mills

New wet-bottom Cottrell electrostatic precipitators, recently developed by Research Corp. of Bound Brook, N. J., will recover salt cake and sodium salts in pulp and paper mills. Rayonier Inc. and Rome Kraft Co. have completed arrangements with Research Corp. for installation of the new precipitators.

The wet-bottom design is a recent development in precipitators for paper mills. Utilizing a circulating black liquor flow, instead of dry dust hoppers and conveyors, a wet-bottom precipitator enables rapid re-use of collected dust.

Maxon Construction Co. will handle installation of precipitators at the sulphate mill of Rome Kraft Co. in Rome, Ga. When completed in August 1953, two precipitators will recover salt cake at a specified collector efficiency of 90 percent from 140,000 cfm. of gases at 275-300 deg. F. The gases will come from a spray type recovery furnace handling 900,000 lb. of black liquor solids per day.

Ebasco Services will install two of the precipitators developed by Research Corp. at the Doctortown, Ga., mill of Rayonier. Fach precipitator will recover sodium sulphate from 100.000 cfm. of gases at 300 deg. F. at a specified collector efficiency of 90.5 percent. Installation is expected to be completed in May 1953. —End



ASK YOUR MATHIESON REPRESENTATIVE

# What's New.

He'll tell you how we can now serve you better than ever before . . . because a lot has happened at Mathieson since contract season last year. He'll discuss in detail:

- 1. Our new activities in the organic field, with a full line of ethylene derivatives from our new Doe Run, Ky. plant, and methanol from the newly acquired Morgantown, W. Va. plant.
- 2. Our new facilities for production of nitrogen products, including large additional production of ammonia from Morgantown.
- 3. Our new and expanded alkali-chlorine facilities, including electrolytic production at Saltville, Va. and a new electrolytic plant at McIntosh, Ala.
- 4. Our new organizational set-up to better serve our customers.
- 5. Our new ideas for the economical distribution and use of Mathieson

These and other new Mathieson developments are worth hearing about. Our plans for tomorrow might well fit into your plans for tomorrow. Let's talk about 1953!

# ATHIESON CHEMICALS

Soda Ash Coustic Soda Bicarbonate of Soda Liquid Chlorine Ammonia Nitrate of Soda Processed Sulphur Sulphuric Acid

Sodium Methylate Sodium Chlorite Chlorine Dioxide **Ammonium Sulphate** Nitric Acid Dry Ice and Carbonic Gas **Hypochlorite Products** 

**Hydrazine Products Ethylene Glycol** Diethylene Glycol Triethylene Glycol **Ethylene Dichloride Ethylene Oxide** Dichloroethylethei Methanol

# SALES OFFICES

Inorganic and Organic Chemicals Departments

Charlotte 2, North Carolina Houston 2, Texas Chicago 11, Illinois Cincinnati 2, Ohio

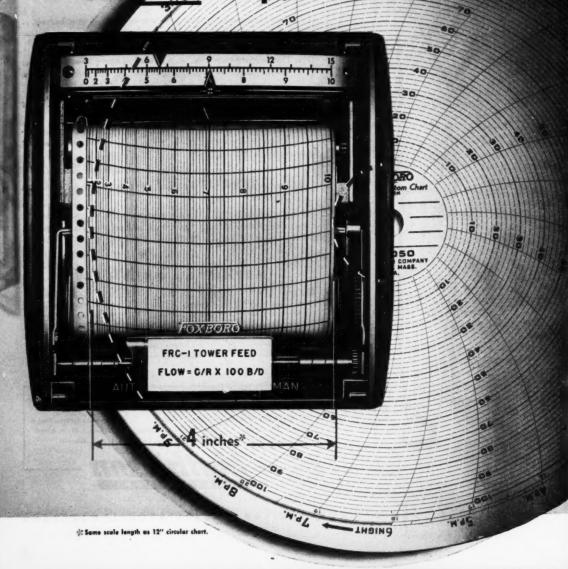
Philadelphia 7, Pennsylvania New Orleans 12, Louisiana Providence 3, Rhode Island St. Louis 2, Missouri

MATHIESON CHEMICAL CORPORATION . BALTIMORE 3. MARYLAND

CHEMICAL ENGINEERING—September 1952

The New CONSOTROL

# The CALY Graphic Panel Instrument



# M<sub>53</sub> RECORDER

# with **FULL SCALE CHART!**

New in concept... new in principle... Foxboro's Consotrol M/53 Recorder combines amazing accuracy and convenience with extreme compactness... and you don't even sacrifice the accurate readability of full size charts. Full 4" wide, 30 day strip chart is same scale as 12" circular charts. What's more, the M/53 is by far the simplest to load, operate and maintain.

Single and 2-pen models, with or without control features, are available. Note some of the typical advantages:

- Exclusive Valve-Position Indicator the only instrument of its type with continuous indication of valve direction . . . no switching required.
- Exclusive Vertical Chart Operation —
  will not run off spools . . . 5 hrs. of chart
  record showing at all times . . . chart loads
  quicker, easier than a box camera.
- Single-Switch Automatic-Manual Transfer — simple one-two operation. Instantaneous and bumpless.
- No Knobs to turn all settings leveroperated . . . quick, precise operation . . . micrometer set-point drive, no backlash.
- Positive Control Point cannot drift.
   Maintained by precision pressure transmitter.

Write for Bulletin 463 which contains full details on the M/53 and the complete Consotrol Line. The Foxboro Company, 369 Neponset Ave., Foxboro, Mass.

# PROVIDES 4 BETTER RECORDING-CONTROLLING SYSTEMS MEASUREMENT TRANSMITTER TRANSMITTER 1. Consotrol Recorder with M/38 Consotrol Controller . . . . recorder and controller . . . . resk-mounted. 2. Consotrol Recorder with M/38 Consotrol Controller . . . resk-mounted. 3. Consotrol Recorder with M/38 Consotrol Controller . . . resk-mounted. 4. Consotrol Recorder with M/39 Consotrol Controller . . . fold-mounted.



# How a network power system prevents shut downs in this process plant

In the new Lever Brothers' Los Angeles plant, which produces soaps, detergents and edible oils, many of the processes are continuous and power stoppages would be extremely costly. So Bechtel Corp., the engineers and constructors, and Westinghouse applied a very advanced type of power system, a "secondary network", that's just about emergency-proof. Here are a few of the nontechnical highlights.

# Substations tied together in network

This system follows the best modern practice of having power substations spotted throughout the plant—each one serving its own area. In addition however, the substations are tied together with emergency cross connections. If there's trouble in any substation, its part of the plant is immediately and automatically served through the neighboring units without even a momentary interruption.

# No stand-by diesel-generator needed

Power enters the plant through either of two main lines from the utility company. If one line should develop a "fault", the automatic throw-over equipment switches to the other line. This system has such high reliability that no stand-by diesel-generator is needed.

# System expanded easily as plant grows

Another important feature of this system is the ease with which additional load expansion can be handled. An increase of 40% in capacity is possible without disturbing the present system.

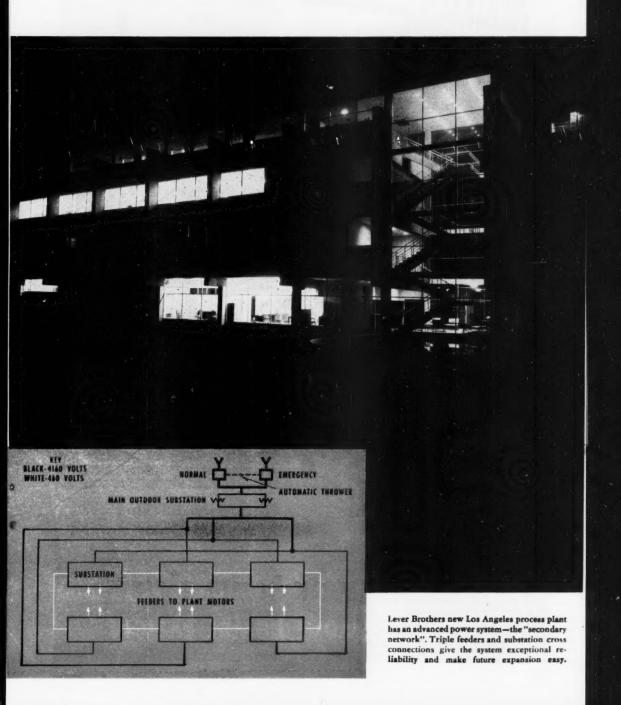
# Call Westinghouse early on your next project

If you want advantages like these, when you're planning on building a new plant, expanding, or modernizing, call your Westinghouse office. We also offer a *complete* line of electrical equipment specifically designed for chemical plants. Westinghouse Electric Corporation, Box 868, Pittsburgh 30, Pennsylvania.





They did what you can do to produce more



# for the best in Stainless Steel CORROSION-RESISTANT FITTINGS - PIPE TUBING - PUMPS and CUSTOM FABRICATION





Tri-Clover "sanitary" type stainless steel fittings are available in sizes from 1 in. thru 4 in. O.D., in a full range of fitting types. Designated and approved as meeting 3-A Standards throughout, incorporating numerous exclusive design and construction features that assure highest quality.

Standards throughout, incorporating numerous exclusive design and construction features that assure highest quality.

A full line of stainless steel tubing and pipe is available for all corrosion-resistant needs in sizes from 1 in. thru 4 in. O.D.



ell and a conical-end tee flanged to standard I.P.S. threaded adapter.)

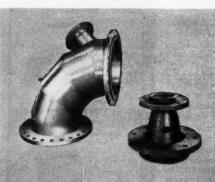
# INDUSTRIAL and SANITARY PUMPS

Tri-Clover offers a full line of centrifugal pumps for handling clear liquids, heavy liquids and semi-solids of all types, for use on sanitary lines in food, dairy and beverage industries — and for general industrial corrosion-resistant service. Capacities from 10 to 1250 gallons per minute.



Fabricated in Stainless Steel Type 304, 347, 316 and other SS analyses. Fabricated in 1.P.S. and O.D. Tube Size from ½ in. thru 36 in.—in ells, tees, crosses, welding nipples, flanges, adapters, etc. Features: Streamlined, sweep ell construction, free-flow, light weight, fully annealed and passivated. A high quality fitting widely used in broad chemical process use.

\* Trada Mark Registered



# CUSTOM

When it comes to expert welding and fabricating of complex custom assemblies, you just can't beat the speed and accuracy offered with TRI-CLOVER'S exclusive Heli-Arc Atomic Hydrogen Welding . . . a specialized semi-automatic process that assures highest quaitity and FULL corrosion resistance (Shown are two examples of the type of "special" jobs we handle every day).



# RECESSED-END FITTINGS

Fabricated in Stainless Steel Types 304, 347 and 316. Here are low cost, light weight, high quality fittings designed for fast, simple soldering, brazing or socket welding. Available in sizes for an extremely wide range of applications, ranging from 36 in thru 24 in. Full line of elbows, return bends, tees, crosses, adapters, etc. Fully annealed and passivated.

LLUSTRATED here are some of the types of stainless steel fittings, pumps, tubing, pipe and custom fabrication that are included in the complete Tri-Clover line of corrosion-resistant liquid conveying line materials.

Tri-Clover fittings are truly quality fittings. To assure the highest possible degree of corrosion, resistance, all industrial fittings are fully annealed and passivated after fabrication. Modern, precision fabrication to close tolerances precludes any need for reworking during installation.

By installing these stainless steel products in your process lines, you will realize the advantages of increased production and lower maintenance costs. Over 30 years of specialized engineering service is at your disposal in helping to solve your specific corrosion-resistant piping problems.

Write for details, or see your nearest Tri-Clover Jobber.

See the complete Tri-Clover line—Booth 205— 1-252
Chicago Chemical Exposition—September 9-13.

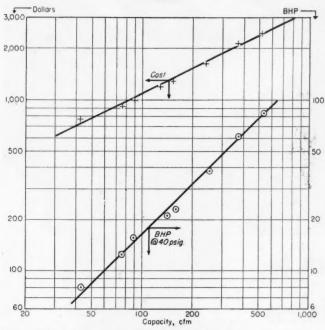
Tri-Clover

TRIALLOY AND STAINLESS STEEL SANITARY FITTINGS, VALVES, PUMPS, TURING, SPECIALTIES





# . Memo from the Editor John R. Callaham



# NEW DATA ON THE COST OF FANS AND BLOWERS

Next month we'll publish what a lot of you have been asking for: An up-to-date, practical article on the cost of fans and blowers used in chemical processing plants. Author R. E. Denzler of Stevens Institute of Technology will include a spate of valuable tables and graphs. The sample above shows the cost of positive rotary compressors made of cast iron. Watch for Denzler's article in our October issue.

# **Much Ado About Reprints**

We've had a flood of letters in recent months from people who want to know about reprints of our feature reports: Are they available? What do they cost? Why don't we put a notice in the reports themselves to let people know that they can get reprints? What the Sam Hill is the matter. . .?

Well, this whole business of reprints has been complicated by a recent Post Office ruling that more often than not embarrasses us, irks you and confuses just about everybody.

First, though, I'll say that we do make reprints of all our feature reports (but not of our articles) and that we make them available to anyone at a small cost.\* You can usually get a reprint of any feature report we've

published within the past year simply by telling us what you want. You'll get faster service if you send the money with your order (otherwise it has to go through a lot of accounting red tape for billing and what not).

Then why don't we let you know in each issue what reports or articles in that particular issue are available? We'd like to—but that's where things get complicated.

The Post Office people now say it's "advertising our services" for us to do that in any way whatsoever—even if we give the reprints away.

And so they charge us the "advertising" postal rate for that entire editorial report when we mail out the 37,500 copies of that particular issue of CE. These "advertising" rates are

 Usually 50¢ each, with discounts for orders of 100 or more copies. A few special reports sell for \$1 each. considerably higher than those for "editorial material." And if it's a big report or if we do it often enough, we can even lose our second-class mailing privileges altogether—and double or triple our postage bill.

We can tell you in the ad we run every month (p. 509) what reports from past issues are available. But we can't do it in any way in a current issue without jacking up our entire mailing costs and throwing our reprint operations (pretty close to a break-even business at best) smack into the red-ink column.

So that's our problem and why we can't keep you better informed on what reprints are available. (The same situation may not apply to other publications; it seems to depend, to some extent, on the local postal authorities)

We hope to lick this whole problem some day pretty soon. Meanwhile, we appreciate your patience.

# Coming Reports . . . .

Here's a line-up of the feature reports we now have planned for the months ahead:

► Adsorption—A six-article symposium that'll cover latest developments in principles, applications, equipment and design. Emphasis will be on practice rather than on theory. Next menth

► Solids Feeding Devices—A survey of what's available for solids and semisolids. Will tell you how to use them in solving particularly knotty problems: How to feed against high pressures, what to do about high temperatures, how to get around difficulties when the feed sticks or balls up.

Protective Coatings—A special report that'll classify and discuss the basic types of protective coatings used to combat corrosion in the chemical process industries. What they are, how well they work, who makes them. This job will be done by an outstanding consultant in the field of corrosion prevention. Watch for it in Decem-

▶ Practical Statistics—How you can put (Continued on page 355)



Here's how a Ryerson customer kept his business going when NPA Order M-80 cut off his supply of nickelbearing stainless. This manufacturer was turning out vacuum tops for coffee dispensers. He was using Type 305 nickel-bearing stainless in his product—thought 305 was the only steel for the job. Restrictions on nickel meant discontinuing production or finding an alternate material.

In his search for an alternate, our customer tried Allegheny Type 430 straight chrome stainless from Ryerson stocks. Results were excellent. The straight chrome steel proved more than just acceptable—it did the job in less time, for less money. Because Type 430 work hardens less rapidly, spinning time was substantially reduced and an annealing operation elimi-

nated. And Type 430 satisfactorily met the finish requirements while costing considerably less than the Type 305 it replaced.

Perhaps Type 430 or some other straight chrome stainless can solve a problem for you. Only a thorough investigation will tell. We are prepared to help you make that investigation—our staff of stainless specialists is at your service. And we are able to supply the needed steel—our stocks of straight chrome types are the nation's largest and most diversified. Since relief from the nickel shortage is still not in sight, we suggest you act now. Call your nearby Ryerson plant for quick action.

PRINCIPAL PRODUCTS: CARBON, ALLOY & STAINLESS STEELS—BARS, STRUCTURALS, PLATES, SHEETS, TUBING, MACHINERY & TOOLS, ETC.

# RYERSON STEEL



JOSEPH T. RYERSON & SON, INC. PLANTS AT: NEW YORK . BOSTON . PHILADELPHIA . CINCINNATI . CLEVELAND . DETROIT
PITTSBURGH . BUFFALO . CHICAGO . MILWAUKEE . ST. LOUIS . LOS ANGELES . SAN FRANCISCO . SPOKANE . SEATTLE

# Chemical Engineering WITH CHEMICAL & METALLURGICAL JENGINEERING

SEPTEMBER 1952

# Why Celebrate Centennials?

This has been a month of anniversaries. Some, such as the great centennial in Chicago, have been of particular importance to engineers. Obviously, it's too soon yet to evaluate the long-time significance of these celebrations. But we can ask ourselves what lessons we've learned, how in recreating the past we have been helped in visualizing the future.

As Charles F. Kettering observed, the engineering profession has good reason to want to make the most of its hundredth birthday. Here was a once-in-a-lifetime opportunity to interest people in a better understanding of what engineers have contributed to national progress—to their daily lives in terms of higher standards of health, comfort, and convenience. And to the extent to which we succeeded in this effort, we have enhanced potentialities for the future of our profession.

Because engineers so seldom deal directly with the general public, most of our work must be known by its results. Too often, especially in the case of chemical engineering, these are end products of industries only remotely related to our activities. But the thoughtful thousands who listened to Chicago broadcasts, watched the dramatization of "Adam to the Atom" over TV, or read the daily newspaper reports of our oratory—all must now have a better realization of at least one important reason why America is great.

They may well have asked themselves: Why is it that with but 7 percent of the world's population the United States produces more than a third of the world's goods? Is it because our engineering population has increased from 25,000 to 400,000 during the past fifty years? If so, isn't it obvious that one way to make America still greater is to encourage, stimulate and inspire interest in the future advance of science and technology?

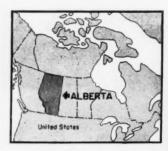
Another significant anniversary some of us may

have overlooked is the fact that West Point was officially founded in 1802, primarily to train engineers. Then there was only one kind—military engineers. They built our bridges and early railroads, dredged our harbors, and, incidentally, applied their technology to munitions and the machinery ("engines") of warfare. Rensselaer Polytechnic came along in 1824 to turn out civilian (civil) engineers who became so prolific that by 1852 ten of them got together to found the American Society of Civil Engineers.

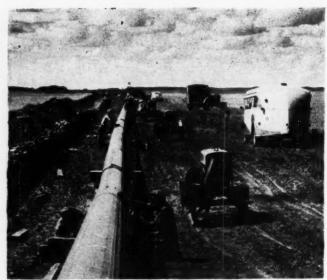
It was from this "mother" society that we all sprang—the miners in 1871, the mechanicals in 1880, the electricals in 1884, and, last but not least among the big five, came the chemical engineers in 1908. Each of the organized branches of the engineering profession therefore owes a debt to ASCE. It set not only the pattern, but the high ethical standards that have characterized the engineering profession. Therefore, it was most appropriate that all should join wholeheartedly in celebrating civil engineering's centennial.

Now the celebration is over. We have cleared the decks for the next hundred years of what we hope will be engineered as well as engineering progress. We will go farthest in that direction if we heed the single, most important lesson that came out of the Chicago centennial, namely, to work together as a unified profession in carrying our story to people in all walks of life. Only with the understanding and support of the general public can we hope to attain the full potentialities of engineering in a free enterprise economy of the future.

Didney Kinhpatrit



With its first real chemical plant only a decade old, Alberta today has a half dozen or more operating or under construction. The magnet: large, cheap sources of oil and natural gas.



RESOURCES: New pipelines will put to work rich endowment of oil, natural gas.

# Alberta's Oil Discoveries Are Building

FRANCES ARNE

The Alberta oil strike in 1947 jolted into being a lusty infant chemical industry. Its growth has been so rapid in the past five years that there's no predicting how much may happen in the next five.

The path of this development and the natural resources behind it immediately suggest the analogy between Alberta and Texas. Both have immense reserves of crude oil and natural gas. While their market and economic conditions differ, present indications strongly point toward a parallel in industrial growth.

Every major oil company in the United States and Canada has a stake in Alberta oil. U. S. capital is behind much of the exploitation of the province's assets—which also include coal, hydropower, limestone, shale, clay, sand, salt and sulphur.

There's also an international struggle under way for the province's natural gas. Developments so far: two pipelines to the U. S., one completed and one under way.

Frances Arne is an editorial assistant for Chemical Engineering. Little doubt exists that Alberta's potential industrial development is greater than that of any other Canadian province. Her oil reserves are now conservatively estimated at over 2 billion bbl.; oilmen are confident at least 5 billion will be found eventually. Reserves of natural gas, proven and probable, total 7-million million

Besides flowing oil from deep wells, Alberta has fabulous surface deposits of bituminous tar sands. These contain potential reserves of oil exceeding in quantity all the world's known resources. They are variously estimated from 100 billion bbl. (Canadian Dept. of Mines & Resources) to 250 billion (U. S. Bureau of Mines). Engineers are pressing technical and economic utilization studies.

One pointed example of the Alberta-Texas comparison is Celanese Corp. of America's new petrochemicals plant at Edmonton. It is essentially the same as one the company is operating in Corpus Christi, Tex. Scheduled to be in operation within a year and a half, the new plant will consume liquid petroleum gases from the Alberta oil fields at rate of 75,000 gal. daily. Natural gas from these fields will be used as fuel in the company's power plant.

# First Wave of Chemical Plants

The Celanese plant is one of the two biggest projects in Alberta to-day. The other is a \$17 million nickel refinery Sherritt Gordon is building in Edmonton to use a revolutionary new chemical process for recovering metals from low-grade ores. Both are chemical industry ventures based on the newly-found oil and gas resources.

Celanese is spending \$54 million on its combined petrochemical and fiber yarn plant. From the petrochemicals portion will come a variety of organic chemicals, some of which have never before been produced in Canada. Feed stock will be from two sources: (1) liquefied butane and propane from gasoline plants; (2) recovered gases from Edmonton refineries.

Oxidation of the liquefied gases will form formaldehyde, acetaldehyde,



GROWTH: So will rush of new chemical plants like this one for petrochemicals.

# A Chemical Industry

propionaldehyde, acrolein, propylene oxide, methanol and acetone. Some formaldehyde will be marketed as a 37 percent formalin solution. The remainder will be reacted with acetaldehyde to make pentaerythritol, which will be produced for the first time in Canada. There will be enough PE to meet Canadian demands with some available for export. Acetaldehyde will be available for sales but most of it will be further oxidized to acetic acid.

The acetic acid will supply the cellulose acetate portion of the plant, leaving a surplus for sale on the Canadian market. The company will produce 25 million lb. a year of cellulose acetate flake by combining acetic acid with wood pulp from the B. C. plant of its affiliate, Columbia Cellulose.

They will process 10 million lb. of the acetate flake to filament yarns and 5 million pounds to staple fibers.

NEW PLANT FOR NEW NICKEL PROCESS

Sherritt Gordon's refinery, to be completed by the end of 1953, will add 8,500 tons of nickel to Canada's present yearly production of 137,500. Raw material, sulphide ore, is to come to Edmonton, the refinery site, from the company's mines in the Hudson Bay area. Cheap supplies of natural gas and an economical new refining process will offset the freight cost. Daily consumption of gas will be 7 million cu. ft.

The new process, developed by Chemical Construction Co. (CE, June 1952, p. 164), involves no roasting. Essentially it's a leach followed by reduction. Ore will be concentrated by conventional flotation procedures, then introduced with acid or ammonia into an autoclave in the form of a slurry. Suitable reducing agents will recover the metals. Varying the conditions of treatment will separate the individual metals as pure powders. Extractions are almost 100 percent effective and the product is of high purity.

Along with the nickel, the refinery will produce 1,000 tons of copper. 150 tons of cobalt and 70,000 tons of byproduct ammonium sulphate.

Another company attracted to Edmonton by an inexpensive, plentiful supply of basic raw material is Chemical Industries Ltd. They were seeking a supply of ethylene to make raw polythene, never before manufactured in Canada.

The ethylene supply was waiting in the natural gas produced in Alberta's Leduc oil field—a natural gas with the richest content of ethylene of any on the continent. By 1953, 10 million cu. ft. a day of gas will flow through a 20-mi. long pipeline from the oil field to CIL's \$13 million polythene plant going up in Edmonton.

Shell Oil Co. has recently become Canada's first producer of elemental sulphur at its Jumping Pond, Alta., natural gas field. Each year the \$500,000 plant will recover 10,000 tons of sulphur, formerly wasted, from H<sub>s</sub>Scontaining gases. The sulphur will be used in the paper mills of Powell River Co.

On the heels of this, Royalite Oil Co. opened a similar plant at its Turner Valley, Alta., gas field. Capacity will be 9,000 tons annually. Process used in both plants is essentially the same as that used in the sour gas fields of southwestern United States.

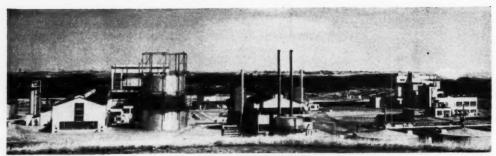
Previously sulphur recovered from this source could not compete economically with Texas sulphur. The shortage changed that and brought Canada an important new source of this element.

SULPHUR AND SALT ARE BASIC

Sulphur and salt products are basic to chemical and industrial developments. Alberta is to produce both Chlorine and caustic are what Canadian Salt Co. Ltd. will turn out by electrolysis of salt at its plant which is now under construction in Lindbergh.

At the Lindbergh site, 120 mi. northeast of Edmonton, are large beds of high purity salt. Water and gas, also readily available, complete the production requirements. Increased refinery capacity and need for caustic together with an increased demand for chlorine has warranted this development.

Canadian Industries Ltd.'s newly completed plant near Calgary gives this continent its first continuous nitration process in a commercial explosives plant. The \$4.5 million plant follows the general pattern of other explosive facilities except in the nitroglycerine section. A continuous Biazzi nitration process will be in-



OLDEST PLANT: Only 11 yr. old, Alberta's first real chemical plant makes ammonia.

stafled there. Products include dynamites, semi-gelatins and gelatins.

At present, Alberta can offer only a few of the major ingredients for commercial explosives manufacture. These include ammonia and ammonium nitrate. For now, other required material will be brought into

the province.

Dominion Oxygen Co. Ltd. has purchased land in Edmonton for a new oxygen and acetylene plant. The proposed plant site is in the heart of the growing oil and chemical industrial area of Edmonton, near the Imperial Oil and McColl-Frontenac refineries and the new Canadian Chemical Co. plant. This is just another expression of the confidence currently being expressed in the future of Alberta by some of the largest industrial companies on the continent.

Granddaddy of all these chemical plants now being rushed into construction is, significantly, only 11 years old. It is the nitrogen plant near Calgary of Consolidated Mining and Smelting Co. of Canada-the first real chemical plant in Alberta.

It now produces 90,000 tons of ammonia annually from natural gas, air and water. Methane from natural gas is combined with steam in the presence of a catalyst in an endothermic reation to give carbon monoxide, carbon dioxide and hydrogen. Carbon monoxide reacts with more steam in the presence of a catalyst to produce carbon dioxide and more hydrogen. Air is burned with natural gas in controlled combustion to produce nitrogen, water and carbon dioxide. Carbon dioxide and carbon monoxide are removed. Carbon dioxide removed by water and a caustic wash and the carbon monoxide removed by an ammonium copper formate liquor. Finally, the nitrogen and the hydrogen are combined under pressure and in the presence of a catalyst to form ammonia.

Part of the ammonia goes into production of 70,000 tons annually of ammonium nitrate fertilizer. Most of the fertilizer is marketed in the U.S.

# PIPELINES MAKE NEWS TOO

Pipelines are another form of new construction making big news in Alberta today. The provincial legislature has just given long-awaited approval to a permit for exporting natural gas to the United States. Westcoast Transmission Co. Ltd. will be allowed to bring 300 billion cu. ft. into the Pacific Northwest over a period of 22 years if the plan is approved by our Federal Power Commission this fall. Gas will travel via a \$100 million pipeline from the Peace River area.

With predictions of a boom in industries using gas-the chemical industry in the forefront-land is being gobbled up from the northern Peace River area to as far south as Vancouver Island.

Alberta had been holding back on allowing gas export until reserves reached a 30-yr. requirement. They have now more than doubled that. The legislature's 300 billion figure is now considered exportable surplus and is open for revision.

Only one other permit for major export of the gas has been approved. This went to Anaconda Mining Co. for defense production in Montana. As a result a 75-mi. pipeline went into operation last February. A \$3.5 million project, the line comes from the Pakowki field in Southern Alberta. Export of 43.8 billion cu. ft. of natural gas over a five-year period has been approved.

# Only a Scratch on Resources

Forecasts are that Alberta's soaring production of crude oil may replace Iran's. The province's oil and gas resources are so vast that their magnitude still is not fully known. Their surface has so far been merely scratched.

The total capital investment in oil in the last five years is placed at \$1,000 million, of which only one or two percent came from outside North America. The largest part came from the U.S.

Alberta's 1951 output brought Canada up from thirteenth to ninth place among the world's leading oil-producing countries. The province's 96 percent contribution to the Canadian total came to 46.4 million bbl. worth some \$118 million.

Since Alberta's first big oil strike in the Leduc field in 1947 Canada has reduced her imports of oil from 90 percent of her requirements to 50 percent. And Alberta's reserves are 1,500 million bbl. a year. The potentially productive region covers 770,000 sq. mi., which is more than the combined area of Great Britain, France, Spain, Italy and Western Germany. It now appears that production may equal consumption in four or five year's time. It has already reduced by \$150 million yearly Canada's need for U. S. dollars with which to purchase foreign oil for Canada's needs.

IRREPRESSIBLE OIL

Great strides toward expanding the market for Alberta oil have been made.

A maximum of 95,000 bbl. a day flows out of Edmonton through the Interprovincial Pipe Line joining the oil fields with Ontario refineries. Additional pumping stations are being built and sections of the line looped to raise oil flow out of Edmonton to 145,000 bbl. a day.

Meanwhile, bush crews are cutting a path through the ranges of the Rockies for an \$82 million pipeline which will move oil from Edmonton to Vancouver. This construction job—one of the toughest pipeline jobs ever to be attempted—will be finished in 1953. Intended capacity of the Trans-Mountain line has already been upped from 75,000 to 120,000 bbl. a day because of new discoveries in the Alberta oil fields. Throughput will start off at a modest 37,500 bbl. a day.

Major refinery construction completed or under way last year promised to boost the province's daily refinery capacity to 65,000 bbl. British American Oil Co.'s \$7 million refinery recently opened at Edmonton. So did McColl Frontenac's, costing a similar amount. Imperial Oil Ltd. (70 percent owned by Standard Oil of N. J.) expanded its Edmonton refinery. Two other refineries were under construction at Stettler and Calgary.

# NATURAL GAS MAGNET

Natural gas is the basis of many of the chemical industry projects under construction in the prairie province.

Until recently industries in Alberta used natural gas as a fuel only. The picture is changing rapidly. Plants like Celanese's for petrochemicals and Canadian Industries Ltd.'s for polythene will soon start using it as a raw material.

Fuel costs, as a rule, are an important item in most plants. In Alberta the consideration is almost non-existent because of the abundance of cheap natural gas.

Consumption of natural gas in Alberta in 1951 was 54,567,414 thousand cu. ft. valued at \$2.7 million. This is an increase of 14 percent over 1950 in both value and volume.

Because natural gas will be used both as a fuel and as a raw material, it is safe to assume a rate of increase of gas consumption higher than either the rate of population or industrial growth in Alberta. Its use as a chemical raw material could represent immense quantities. For example the first plant to so use it, Alberta Nitrogen's ammonia plant, consumes about one quarter as much gas as the city of Calgary.

### GREATEST POTENTIAL

In her oil sands deposits on the Athabasca River, Alberta has a vast potential resource that now seems to tantalize the petroleum industry like pirate gold. To the chemical industry, the sands are of interest not only as a source of liquid fuel, but for their 5 percent sulphur content.

Finding an economic method of extracting the oil from the sands has been the work of a pilot plant at Bitumount, Alta., operated by the provincial government. Last year they announced satisfactory development of methods of mining, separation of bitumen from the sands, and reduction of the high-sulphur content bitumen to a crude acceptable for conventional refinery method.

One problem is still unsolved: what to do with the huge quantities of sand after bitumen separation. Yet Swedish Shale Oil Co. has leased the government's separation facilities and is currently testing a method of removing the oil at the mining site.

One way or the other, 12 oil companies have indicated that they will go ahead with tar sand extraction plants. Their prospecting permits cover over 400,000 acres. The entire oil sands deposit is 80 mi. long and 30 mi. wide at some points.

### TRIPLE-THREAT FUTURE

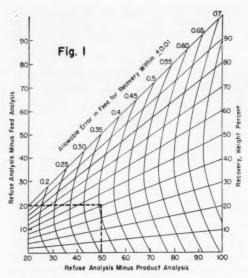
This vigorous industrial activity is only the beginning. There is every suggestion that it will triple in the next few decades.

In 1951 alone, 15 new industries were established in Alberta. They are manufacturing or will manufacture such products as chemicals, rayon, plastics, petroleum products and storage batteries. The capital cost of the new plant construction was approximately \$97 million creating employment for 2,700 persons. During the year 1951, 22 companies established branch offices, warehouses, or made major plant extension in Alberta. Value of this class of development totalled \$8 million.

With bulging stores of natural resources at its elbow, Alberta's chemical and oil refining industries has no choice but to grow. And, of utmost importance to this growth, the whole of Canada is growing up. The country is proving itself large enough to support domestic industry on the large production scale that the modern chemical industry demands.



GREATEST POTENTIAL: Engineers may soon tap Alberta's fabulous oil sands.



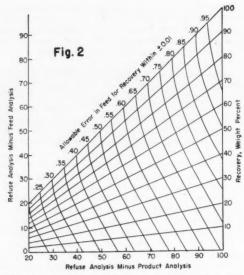


Chart for estimating required sampling precision if sampling errors are equal for feed, product and refuse (or bottoms).

This chart aids estimation of necessary sampling precision when product sampling error is negligible.

# **Use Statistical Averages for More Precise Material Balances**

Here's how statistics can be applied to the treatment of physical separation data—making average accuracy a function of number of samples taken.

# M. G. BOOBAR and H. J. DONALD

Dependable material balances are vital to the efficient operation of physical separation operations. And not infrequently they serve as a basis for comparing separation methods.

However, securing reliable material balance information is often difficult, particularly when feed stream components vary in concentration. Existence of this condition forces the use of average values. Then the problem becomes one of obtaining correct averages.

Such a situation was faced during recent performance evaluations of a number of fine coal cleaning plants in the anthracite industry. Preliminary tests indicated there were wide fluctuations in ash content of successive samples taken from the various streams. Close checking corroborated the evidence. Faced with this condition a statistical approach was developed to prescribe test procedure and treat the data.

It is felt that the method is equally applicable to other

physical separation operations such as distillation, absorption, adsorption, extraction, evaporation and classification or particle size separation.

### SIMPLE MATERIAL BALANCE

The discussion which follows is developed for the simple and most common case where an entering feed stream is divided into two exit streams. For ease of explanation the larger of the two exit streams will be called product (P)

# NOMENCLATURE

- F = Weight of feed per unit time.
- P = Weight of product per unit time.
- B = Weight of bottoms per unit time.
- f = Percent of given component in F.
- p = Percent of given component in P.
- b = Percent of given component in B.
   W = Percent recovery of feed as product.
- e = Confidence limit for material denoted by subscript.
- n = Number of samples.
- s = Standard deviation.
- x = Arithmetic mean of n observations.
- a = Probability factor.

MURRAY BOOBAR and JACK DONALD are Research Assistants in Fuel Technology, School of Mineral Industries, The Pennsylvania State College.

	Confidence Limits, X ± as		
Number of Observations in Sample	90 Percent Confidence Limits	95 Percent Confidence Limits	99 Percent Confidence Limits
	Value of a	Value of a	Value of a
4	1.359	1.837	3.372
5	1.066	1.388	2.302
6	0.901	1.150	1.803
7	0.793	0.999	1.513
8	0.716	0.894	1.322
9	0.658	0.815	1.186
10	0.611	0.754	1.083
11	0.573	0.705	1.002
12	0.541	0.664	0.936
13	0.514	0.629	0.882
14	0.491	0.599	0.835
15	0.471	0.573	0.796
16	0.453	0.550	0.761
17	0.436	0.530	0.730
18	0.422	0.512	0.703
19	0.409	0.495	0.678
20	0.397	0.480	0.656
21	0.386	0.466	0.636
22	0.376	0.454	0.618
23	0.366	0.442	0.601
24	0.357	0.431	0.585
25	0.349	0.421	0.571
n greater than 25	1.645	1.960 a =	2.576
tisali 25 a	$\sqrt{n-3}$	$\sqrt{n-3}$	$\sqrt{n-3}$

and could be synonymous with distillate, extract or oversize depending on the type of separation involved. Refuse or bottoms (B) is the descriptive term applied to the lesser of the two streams and could refer equally well to undersize, tailings, or raffinate.

Basic to the treatment of data by this method is the relationship of total quantity of product divided by total feed. This will be called recovery meaning the fraction or percentage of initial feed that reports in the product stream.

An approach to the problem depends first on establishing the error that can be tolerated in calculated recovery. An expression is developed to give the amount of allowable error in sampling feed, product and bottoms while still maintaining the necessary recovery tolerance. The standard deviation in feed stream analysis is used in combination with the allowable sampling error to arrive at the number of samples required to give an average recovery answer within the specified tolerance.

Conversely, the confidence limit or expected error for a given test can be determined as a function of the number of samples and the standard deviation.

Overall and component material balances may be written for any three stream system as follows:

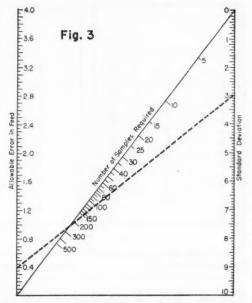
$$F = P + B \tag{1}$$
  
$$fF = pP + bB \tag{2}$$

Eqs. (1) and (2) can be reduced to:

$$fF = b (F - P) + pP$$
 (3)  
 $P/F = (b - f)/(b - p) = W$  (4)

# PROBABLE ERROR

Eq. (4) is an expression for an indirectly measured quantity W, in terms of directly measured quantities or concentrations of feed, product and bottoms. Worthing



Nomograph gives number of samples needed for definite sampling precision and standard deviation.

and Geffner' presented a general expression for determining the precision index of an indirectly measured quantity in terms of directly measured quantities, and their precision indices. If the corresponding values from our material balance are substituted in the Worthing-Geffner equation the following expression for probable error results:

$$e_W^2 = \left(\frac{\partial W}{\partial b}\right)^2 e_p^2 + \left(\frac{\partial W}{\partial p}\right)^2 e_p^2 + \left(\frac{\partial W}{\partial f}\right)^2 e_f^2$$
 (5)

Starting with Eq. (4) differentiation of **W** with respect to b, p and f respectively produces values for direct substitution in Eq. (5):

$$ew^{\mathbf{z}} = \frac{1}{(b-p)^{\mathbf{z}}} \left( e_{\mathbf{z}}^{\mathbf{z}} \right) + \frac{W^{2} - 2W + 1}{(b-p)^{\mathbf{z}}} \left( e_{\mathbf{z}}^{\mathbf{z}} \right) + \frac{W^{\mathbf{z}}}{(b-p)^{\mathbf{z}}} \left( e_{\mathbf{p}}^{\mathbf{z}} \right) \ (6)$$

which reduces to

$$e_W = (2W^2 - 2W + 2)^{0.5} (e_f)/(b - p)$$
 (7)

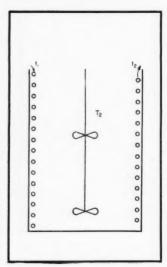
if it is assumed that  $e_p$ ,  $e_t$ , and  $e_b$  are equal.

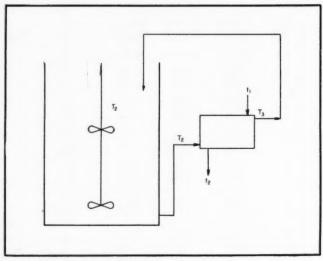
This assumption is justified if the fluctuations in p and b are a function of the fluctuation in f. Since the feed divides into two ends, the fluctuations in these ends could not be greater than those in f, provided the number of samples taken on each end are equal. Thus, the use of Eq. (4) would give a conservative estimate of the errors in recovery.

Eq. (7) gives a definite relationship between  $e_w$  and  $e_r$ . It is now necessary to outline means for sampling the streams such that  $e_r$  will be held within the range required by the specified  $e_w$ .

For most practical purposes a sampling is adequate which provides 95 percent confidence in e<sub>t</sub>. This confidence limit for averages is given by the expression\*

(Continued on page 355)





SUBMERGED coil exchanger.

EXTERNAL counter-flow exchanger.

# How to Tailor Exchanger Area To Fit Batch Cooling Time

You can use a cooling curve equation to link time with other factors needed to calculate heat transfer area. Time in batch cooling operations is a prime economic factor.

### RALPH A. TROUPE

Batch cooling involves heat transfer under conditions of unsteady state. In most instances authors of heat transfer texts have not dealt with this condition to any great extent. An exception to this is Kern' who has calculated the cooling time based on a known heat transfer area.

However, to date no method has been offered for the calculation of area required to cool a liquid batch in a given time interval. It is felt that the method covered by this article may serve to fill that gap.

In any liquid cooling problem there is a temperature differential between the liquid being cooled and the coolant. This is the driving force that transfers heat from the hot liquid to the coolant. However, in a batch or unsteady-state operation the temperature differential continually decreases during the cooling cycle, due to the temperature level drop of the liquid being cooled. Rate of heat transfer decreases accordingly.

Where cooling is performed under steady-state conditions such as exist in a continuous process, Fourier's equa-

tion  $Q = U \Lambda \Delta t_m$  is suitable for calculating heat transfer area. In order to apply this equation to batch or unsteady-state cooling it is first necessary to provide a method for determining Q and  $\Delta t_m$  at any instant during the cooling cycle or as functions of time  $\theta$ .

### NOMENCLATURE

- T<sub>1</sub> = Original liquid temperature.
- $T_2$  = Liquid temperature at time  $\theta$ .
- $T_3$  = Exchanger liquid outlet temperature at time  $\theta$ .
- = Inlet coolant temperature.
- $t_2$  = Outlet coolant temperature at time  $\theta$ .
- $\theta$  = Time in min.
  - = A constant.
- Q = Heat transfer rate, Btu. per sq. ft. per min.
- S = Slope, deg. F. per min.
- M = Total gal. in liquid batch.
- g1 = Liquid density, lb. per gal.
- g = Coolant density, lb. per gal.
- $Cp_1 =$ Liquid specific heat.  $Cp_2 =$ Coolant specific heat.
- B = Liquid circulating rate, gpm.
- G = Coolant circulating rate, gpm.
- B<sub>m</sub> = Minimum liquid circulating rate, gpm.
- G<sub>m</sub> = Minimum coolant circulating rate, gpm.
   U = Over-all coefficient of heat transfer, Btu. per sq. ft. per hr. per deg. F.
- $\Delta t_m = \text{Log mean temperature difference.}$
- A = Heat transfer area, sq. ft.

RALPH TROUPE is the Assistant Technical Superintendent, Goodyear Synthetic Rubber Corporation, Akron, Ohio. Dr. Troupe has had wide experience in the synthetic rubber industry and as a professor of chemical engineering.

Solution of this problem will be developed for two different batch cooling set-ups. The first of these is a batch tank cooled by submerged internal coils. A batch tank connected, in closed system, to an external counter-flow heat exchanger comprises the second.

# REQUIRED DATA

Approach to a solution for each set-up varies somewhat but the following data are needed for both:

- 1. Quantity of liquid to be cooled.
- 2. Physical properties of liquid to be cooled.
- 3. Temperature range through which liquid is to be cooled.
  - 4. Cooling time allowed.
  - 5. Inlet coolant temperature.
  - 6. Coolant flow rate.

### COOLING CURVE: COIL

First consideration is given to the tank having a submerged internal cooling coil. Temperature of any liquid being cooled uniformly (i. e., with sufficient mixing to avoid temperature gradients) will follow an exponential curve of the form  $y = Ae^{-bx}$  (known as the "dying away" function). This equation, applied to the batch cooling of a liquid, takes the form

$$T_2 - t_1 = (T_1 - t_1) e^{-b\theta}$$
 (1)

Looking at the basic equation for the exponential curve it is seen that y and x are the only variables. In writing Eq. (1) the variable y of the basic equation is replaced by the expression  $T_s - t_{ij}$  the temperature difference between the liquid and the inlet coolant at time  $\theta$ . Variable x of the basic equation is replaced by the variable time  $\theta$ .

Before Eq. (1) can be utilized on a specific problem the value of b must be determined. At the termination of a given cooling cycle all values in Eq. (1) are known except b. This is true since  $T_1$  and  $t_1$  as well as  $T_2$  at maximum time 0 are listed in the original problem statement. By using these values in Eq. (1) b can be calculated. Knowing the value b permits solving Eq. (1) for  $T_2$  at various time intervals. Values of  $T_2$  plotted against 0 give the liquid cooling curve similar to Fig. 1.

### SLOPE OF CURVE

Next step is to determine the rate of temperature change in the liquid at any time 0. From this is calculated the instantaneous rate of heat transfer and the outlet coolant temperature at any time interval.

Temperature rate change corresponds to the slope of the curve for Eq. (1). Differentiating Eq. (1) with respect to 0 gives the slope of the curve.

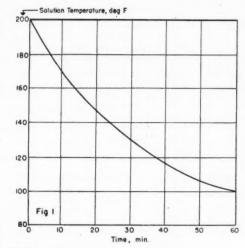
Slope = 
$$dT/D\theta = -b (T_1 - t_1) e^{-b\theta} = -b (T_2 - t_1)$$
 (2)

# SLOPE DERIVATIVES

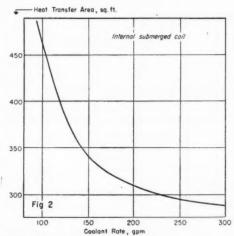
Since the amount of heat transferred at any instant is a function of the slope it is now possible to write an instantaneous heat balance for the heat transfer system:

(S) (M) 
$$(g_1)$$
  $Cp_1$  =  $-b(T_1 - \iota_1)$  (M)  $(g_1)$   $(Cp_1)$   
=  $G(g_1)$   $(Cp_2)$   $\iota_2 - \iota_1$  (3)

For a given rate of coolant flow Eq. (3) can be solved for the exit coolant temprature at any instant in the cooling cycle. Values for t<sub>2</sub> have a direct bearing on the value



BATCH cooling curve.



COOLANT rate effect on submerged coil area.

of  $\Delta t_m$  used in the Fourier equation for calculating the final heat transfer area. Thus to determine the effect of various coolant rates on the required heat transfer area, Eq. (3) is solved for values of  $t_a$  at different coolant rates.

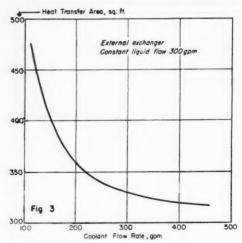
The slope expressed by Eq. (2) is also required for writing the instantaneous rate of heat transfer in Btu. per min.:

$$Q = (S) (M)^*(g_1)(Cp_1)$$
 (4)

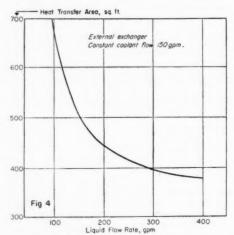
Log mean temperature difference  $\Delta t_m$  can now be calculated using values for  $T_z$  and  $t_z$  as previously determined:

$$\Delta t_m = \frac{(T_1 - t_1) - (T_2 - t_2)}{2.3 \log \frac{T_2 - t_1}{T_2 - t_2}}$$
(5)

Over-all coefficient of heat transfer can be calculated by following the methods given in Kern<sup>1</sup>, Stoever<sup>2</sup> or McAdams<sup>3</sup>. It can also be estimated by reference to tables of heat transfer coefficients in Perry<sup>4</sup> or McAdams<sup>3</sup>.



COUNTER-FLOW area change with coolant rate.



LIQUID rate influence on counter-flow area.

### HEAT TRANSFER AREA

All the derivations of variables affecting the Fourier equation have now been established so that calculation of heat transfer area can be made using

$$A = Q/U\Delta t_{\rm in} \qquad (6)$$

Of course care must be taken to use values for Q and  $\Delta t_m$  which stem from the same time interval. It can be seen that the area will be the same regardless of the time interval chosen. This allows making check calculations.

### EXCHANGER APPLICATION

Reference is now made to the case of a batch tank connected in closed system to an external counter-flow heat exchanger. Equations for the cooling curve, its slope and the instantaneous rate of heat transfer are identical to those cited for the internal submerged coil. Examination of the equation for the curve shows the reason for this to be

that temperature range and time determine the nature of the curve. Generally speaking the type of equipment set-up will not necessarily affect these variables.

# MINIMUM FLOW RATES

With the external exchanger it is desireable to determine minimum liquid and coolant flow rates necessary to achieve required cooling. Once Q, the instantaneous rate of heat transfer, has been determined an equation can be written showing the liquid rate required per unit time to transfer Q amount of heat. Maximum temperature range between solution at time  $\theta$  and coolant inlet temperature is used in the expression.

$$Q = B_m(g_1) (Cp_1) (T_2 - t_1)$$
 (7)

The flow rate of coolant required to absorb the same amount of heat is determined in a similar manner.

$$Q = G_m(g_2) (Cp_2) (T_2 - t_1)$$
 (8)

Once the minimum rates are calculated, it is only necessary to select practical flow rates in excess of these values.

# DISCHARGE TEMPERATURES

The temperature of the liquid emerging from the heat exchanger at any time is obtained by rewriting the heat balance and solving for  $T_s$ .

$$Q = B(g_1) (C_{p_1}) (T_2 - T_3)$$
 (9)

Exit coolant temperature can also be determined in a like manner

$$Q = G(g_2) (Cp_2) (t_2 - t_1)$$
 (10)

With the method for securing the various temperatures now established  $\Delta t_m$  can be calculated

$$\Delta t_m = \frac{(T_3 - t_1) - (T_2 - t_2)}{(T_3 - t_1)}$$

$$2.3 \log \frac{(T_2 - t_2)}{(T_2 - t_2)}$$
(11)

Over-all coefficient of heat transfer may be secured from the same sources as previously noted for the internal submerged coil. Final heat transfer area can then be calculated with Fourier's equation.

# SAMPLE PROBLEM: COIL

To illustrate the approaches that have been outlined two sample problems are now worked out.

A tank fitted with an internal submerged coil contains 2,500 gal. of liquid assumed to be water. Water at 80 deg. F. will be used to cool the liquid from 200 to 100 deg. F. in 60 min. Calculate the heat transfer area and the cooling water rate required.

First step in the calculation is to apply Eq. (1) to the specific conditions of the problem. It will be remembered that the first step requires determining the value of the constant b.

$$100 - 80 = (200 - 80) (2.718)^{-606}$$

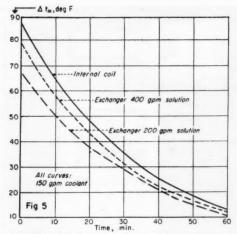
$$b = 0.0298$$

This value of b is used in Eq. (1) while solving for  $T_{\bullet}$  at various values of  $\theta$ . At  $\theta = 10$ 

$$T_2 - 80 = (200 - 80) (2.718)^{-0.0000(10)}$$
  
 $T_2 = 169 \text{ deg. F.}$ 

while at 50 min.  $T_2 = 107$  deg. F. A plot of the curve for this problem is shown in Fig. 1.

Eq. (2) gives the slope of the curve. At 10 min.:



COMPARISON of Atm for various conditions.

$$S = -0.0298 (169 - 80)$$
  
 $S = 2.65 \text{ deg. F. per min.}$ 

and at 50 min. S = 0.805 deg. F. per min.

Eq. (3) gives the exit water temperature  $t_2$ . This calculation requires the use of previously determined values for S. At 10 min. with G = 150 gpm.

$$(2.65)$$
  $(2,500)$   $(8.33)$   $(1) = (150)$   $(8.33)$   $(1)$   $(t_9 - 80)$ 

$$t_1 = 124 \text{ deg. F.}$$

and at 50 min.  $t_2 = 93$  deg. F. By calculating several  $t_4$  values for each of several water rates, relationships are developed which permit plotting Fig. 2 after the final areas are calculated.

Use of Eq. (4) provides the rate of heat transfer in Btu. per min. at any instant 0. Thus at 10 min.

$$Q = (2.65) (2500) (8.33) (1)$$
  
 $Q = 55,300 \text{ Btu. per min.}$ 

and at 50 min.

Q = 16,750 Btu. per min.

Log mean temperature differences are now calculated using Eq. (5). At 10 min, where  $t_2$  was determined at a coolant rate of G = 150,  $\Delta t_m = 64.5$ ; while at 50 min.  $\Delta t_m = 19.8$ .

Perry<sup>4</sup> offers values for U of 150 to 300 Btu. per sq. ft. per hr. per deg. F. for this type of batch cooling operation. In the illustrative problem a value of 150 will be assigned to U.

Heat transfer area is now calculated with Fourier's equation using values determined at G=150 gpm. Check calculations are shown for the cooling cycle time intervals of 10 and 50 min.

$$A = 55,300 (60)/(150) (64.5)$$
  
 $A = 342 \text{ sq. ft.}$ 

and the check calculation at 50 min.

$$A = 16,750 (60)/(150) (19.8)$$
  
 $A = 339 \text{ sq. ft.}$ 

Similar calculations using  $\Delta t_m$  values for other water rates provide different areas for plotting against the water rate as shown in Fig. 2.

Examination of this curve shows that the greatest effect of cooling water rate on heat transfer area is in the range from 100 to 200 gpm. Increasing the flow of coolant above

200 gpm, results in negligible reduction of the heat transfer area.

# SAMPLE PROBLEM: EXCHANGER

The second sample problem is identical with the first except that the cooling area is in a heat exchanger external to the tank. Since the temperature range and time are the same as in the first illustrative problem the liquid cooling curve will also be identical. This in turn means that values for  $T_{\mathfrak{p}}$ , S and O will be the same.

Minimum liquid and coolant flow rates are now calculated.

$$B_m = 55,300/(1)$$
 (89) (8.33)

 $B_m = 75 \text{ gpm.}$ and  $G_m = 75 \text{ gpm.}$  since in this instance both liquid and coolant are water.

Choice of 150 gpm. coolant rate provides an interesting comparison with the submerged coil using the same coolant rate. Circulating rate for liquid being cooled is selected as 300 gpm.

Values for  $T_n$  and  $t_n$  are now calculated for the flow rates chosen at time intervals of 10 and 50 min.

$$\begin{array}{lll} T_3 = 169 - 55,300/(300) & (8.33) \\ T_3 = 147 & \deg. F, \text{ at } 10 & \min. \\ T_3 = 107 - 16,750/(300) & (8.33) \\ T_3 = 100 & \deg. F, \text{ at } 50 & \min. \\ t_2 = 55,300/(150) & (8.33) + 80 \\ t_3 = 124 & \deg. F, \text{ at } 10 & \min. + 80 \\ t_4 = 16,750/(150) & (8.33) + 80 \\ t_2 = 93 & \deg. F, \text{ at } 50 & \min. \end{array}$$

Using these temperatures  $\Delta t_m$  is calculated at the same time intervals using Eq. (11),  $\Delta t_m = 55.4$  deg. F. at 10 min. and at 50 min  $\Delta t_m = 16.9$  deg. F.

Over-all heat transfer coefficient U is again taken as 150 Btu. per sq. ft. per hr. per deg. F. based on Perry. Heat transfer area for the exchanger can now be calculated, at both 10 and 50 min. as a means of checking the results.

$$\begin{array}{l} A = 55,300~(60)/(150)~(55.4) \\ A = 399~{\rm sq.~ft.} \\ A = 16,750~(60)/(150)~(16.9) \\ A = 397~{\rm sq.~ft.} \end{array}$$

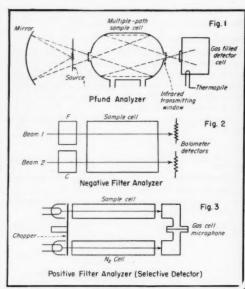
# COMPARISONS .

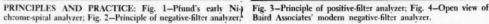
Identical conditions were selected for the illustrative problems except for liquid circulation rate which does not have an assigned value for the submerged coil. With such conditions the calculations showed more heat transfer area required for the external coil than for the submerged coil. The reason is that the submerged coil has a larger  $\Delta t_{\rm m}$ . However by using a higher liquid and/or coolant circulation rate through the counter-flow exchanger the  $\Delta t_{\rm m}$  for that unit can be increased thus narrowing the spread in required heat transfer area for the two units. See Fig. 3, 4 and 5.

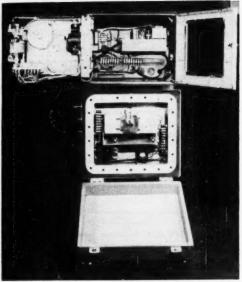
Increasing circulation rates will also tend to change *U*, the over-all coefficient of heat transfer. In the problems minimum values of *U* from the tables were used and these happened to be identical in each case. In actuality *U* for the counterflow exchanger might have the larger value thus decreasing the calculated required heat transfer area.

### REFERENCES

1. Kern, D. Q., "Process Heat Transfer," McGraw-Hill Book Co., New York, (1950).
2. Stoever, H., "Applied Heat Transmission," McGraw-Hill Book Co., New York, (1941).
3. McAdams, W. H., "Heat Transmission," McGraw-Hill Book Co., New York, (1942),
4. Perry, J. H., "Chemical Engineers' Handbook," McGraw-Hill Book Co., New York, (1960).







# Infrared Analyzers for Processes

Process engineers, aware of the growing trend toward automatic analysis instrumentation for plant use, are becoming particularly interested in the now-developing infrared non-dispersive analyzer.

### W. A. PATTERSON

Every plant instrument engineer is faced with a major problem in transferring useful analytical instruments or techniques from the laboratory and making them work under plant conditions. Use of infrared absorption has been especially tantalizing in this respect. In spite of its firmly established value as a quantitative analytical tool, even the most rugged and stable infrared spectrometer is not generally suitable for plant stream use. In addition, spectrometers are relatively costly, and

W. A. Patterson, project engineer of the Process Controls Division of Baird Associates, Inc., Cambridge, Mass., was coauthor of our article on the general subject of end-point analysis instrumentation in May 1952. The present paper is based on one he gave before the annual meeting of the Society of Applied Spectroscopy, New York, May 1952.

when working with complex mixtures having overlapping absorption bands, may require some mathematical com-

Fortunately, infrared absorption techniques can be used in another way in plant instruments that are accurate, rugged, stable, and relatively cheap. Such instruments can compensate for the presence of other components in the plant stream, avoiding computation. They are the so-called non-dispersive type, having no dispersing element (prism or diffraction grating). Their principle is unique—use of a concentrated form of the measured component as an optical self-filter, which makes possible the infrared nondispersive plant stream analyzer.

The fundamental principle is by no means new. In 1926, Hans Schmick took out a German patent on a selffilter instrument, but the latent possibilities of the technique were not realized until 1939, when A. H. Pfund designed a more elaborate unit for the detection of one component. Pfund's first instrument employed a jet of hot gas as the source of radiation. This hot gas was the standard component for which an analysis was desired. The gas mixture being analyzed was put in the sample cell. Since the emission spectrum of a hot gas is approximately the same as the absorption spectrum of the gas when cold, the radiation from the jet was reduced in intensity on passing through the sample cell by an amount which varied with the concentration of that component in the sample cell. A thermopile then detected this variation in in-

Pfund's second instrument, Fig. 1, used a Nichrome wire spiral as a source of radiation. The radiation passed through a sample cell, then through a detector cell filled with a

high concentration of that component of the gas mixture for which an analysis was desired. The gas absorbed and was heated only by that radiation which corresponded to its infrared absorption spectrum. The amount of effective radiation reaching the detector cell, measured by a thermopile, varied with the concentration of that particular gas component in the sample cell.

# ANALYZER PRINCIPLES

Two general ways of applying the self-filter principle have evolved from these original conceptions, known respectively as the "Negative-Filter" method, and the "Positive-Filter"

In the negative-filter method, Fig. 2, two equal beams of radiation are passed through a common sample cell. One of the beams passes through a filter cell F and the other through a compensator cell C, the use of which will be explained later. The two beams then fall on two detectors, which form part of an electrical bridge circuit. In analyzing a mixture of gases for a component A, a high concentration of A, (usually 100 percent) is put into the filter cell. Thus, this beam of radiation, on passing through the filter cell, is reduced in intensity by an amount equal to the integrated sum of all the infrared absorption bands of A. The gas mixture being analyzed is put into the sample cell. Theoretically, from Beer's Law, if the concentration in the filter cell is high enough, any variation in component A in the gas sample will not appreciably affect the intensity of this beam of radiation. On the other hand, the intensity of Beam (2) will vary with the concentration of component A. Absorption due to other components in the gas sample would affect both beams by the same amount, so the difference in the intensity of the two beams is a measure of the concentration of component A. In this simple explanation, it is assumed that the absorption bands of other components do not overlap those of component A.

In the positive-filter method, Fig. 3, we again have two equal beams of radiation, one of which passes through a sample cell, the other through a cell containing an inert gas such as nitrogen. These two beams fall on either side of a detector cell, which is divided into two parts by a thin membrane or

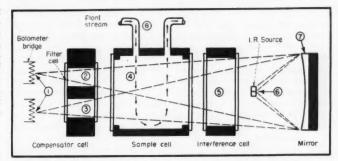


Fig. 5a-Schematic diagram of Baird Associates' plant stream analyzer.

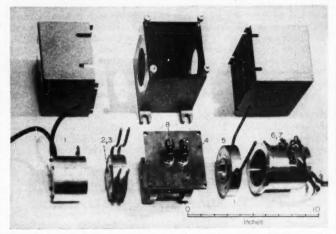


Fig. 5b-Optical components of Baird Associates' analyzer, numbered as in Fig. 5a.

diaphragm (gas microphone in the figure). Here component A is put into both sides of the detector cell. It will absorb only that radiation corresponding to its infrared absorption spectrum, excluding all other radiation. When radiation is absorbed, the gas is heated and will expand. If there is a difference in the amount of energy absorbed on the two sides of the detector cell, then the membrane will be displaced. This displacement can be measured by making the membrane one plate of an electrical condenser, the other plate being fixed in position. The presence of component A in the sample cell would reduce the amount of effective radiation reaching that side of the detector cell, and the resulting displacement of the thin membrane would be a measure of the concentration.

Basically, the difference in the two methods is as follows: In the negativefilter methods the detector measures the energy of the beam reduced by an amount equal to the absorption of the sensitizing component. However, in the positive-filter method only that energy absorbed by the sensitizing component is measured. Instruments based upon these two methods are also known respectively as "Non-Selective" Detector and "Selective" Detector analyzers, according to the role played by the respective detectors.

# SENSITIZING AND DESENSITIZING

Because absorption bands of other components in a sample may overlap those of the component being analyzed, the operation of a modern analyzer is much more involved than this description would suggest. So let us examine a modern gas analyzer. The Baird Associates' gas analyzer, which is based on the negative-filter principle, is shown opened in Fig. 4. The schematic diagram appears in Fig. 5a, while Fig. 5b shows the component parts similarly identified. This instrument

(Fig. 5) has a common sample cell. a common interference cell, a compensator cell in one beam, and the filter cell in the other. The two beams pass to two bolometers which form part of a wheatstone bridge circuit. Their signal is amplified and passed to a recorder. An advantage of this instrument for plant use is that it has no moving parts. It is, however, susceptible to changes from the ambient temperature, and so is enclosed in a compartment normally thermostated at 150 deg F. ± 0.1 deg. Thermostating is not necessarily a disadvantage. (1) Many applications are on vapors at temperatures above ambient and, for these, any gas analyzer would have to be thermostated. (2) Since the amount of gas in the volume of the sample cell depends on temperature and pressure, there should not be any significant variation in the temperature of the gas.

A typical sensitizing procedure on this gas analyzer is shown by the analysis of ethylene in the presence of ethane and methane. The infrared absorption curves for these three gases are shown in Fig. 6. Examination of these spectra show that, if the instrument should be sensitized for ethylene by placing ethylene in the filter cell, it would also be partially sensitive to both methane and ethane.

This is because some of the absorption bands of ethylene overlap those of ethane and methane. The overlap between ethylene and ethane is quite serious. Overlapping of the absorption bands of methane with ethylene is mainly in the 3-4 micron region, whereas the overlapping absorption bands of ethane are in the 3-4 micron region, at about 7 and between 11 and 12 microns.

The usual method of desensitizing a gas analyzer to an interfering gas is to place that gas at a pressure of 1 atm. in the interference cell. In effect, the radiation of both beams is then buffered against variations in concentration of the interfering gas. In this case this would work very nicely for methane, where the only overlap is in the 3-4 micron region. Methane absorbs much less strongly in this region than either ethylene or ethane. The ethane interference is so severe. however, that an excessively long interference cell would be required to remove it by this method. This is where the compensator cell becomes of major importance.

As the sensitivity to ethylene is achieved by placing ethylene in the

filter cell, and nothing or an inert gas in the compensator cell, the addition of any ethylene to the compensator cell would reduce this sensitivity until, if enough ethylene were added, there would be no sensitivity. Similarly, since the ethane bands overlap these ethylene bands, and the filter cell is sensitized to ethane, this sensitivity to ethane can be reduced by adding ethane to the compensator cell. It could be eliminated completely if the correct concentration were used. This would also reduce slightly the sensitivity to ethylene, for the region of overlap of ethane with ethylene is thereby desensitized, but this is not too serious.

In adding an interfering gas to the compensator cell, it is necessary to make sure that the instrument is not thereby sensitized in the reverse direction to this interfering gas, due to the absorption of bands which do not overlap those of the gas in the filter cell. If the non-overlapping bands are at long wavelengths, there may be no problem since the energy from the source at long wavelength is very much less than at short wavelengths. Therefore, absorption bands at long wavelengths would absorb considerably less energy than those at shorter wavelengths. Consequently, bands at long wavelengths would generally have less tendency to reverse sensitize than those at short wavelengths.

If reverse sensitization does occur, there are a number of procedures that can be followed: (1) Some of the interfering gas added to the compensator cell could be added to the interference cell, instituting some buffering action. This is the way it is done in the analysis of ethylene in the presence of methane and ethylene. (2) A second gas could be added to the filter cell which has absorption bands corresponding to those which are causing the reverse sensitizing in the compensator cell. (3) Instead of adding the interfering gas to the compensator cell, another gas could be used, the bands of which approximate more closely only the region of the spectrum of overlap by the interfering gas to the sensitizing gas. (4) If suitable, another gas than the normal sensitizing gas could be used in the filter cell. Such a gas would not have the overlap and, while still sensitive to the required gas would not be sensitive to the interfering gas. (5) The

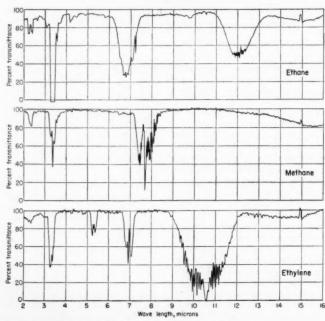


Fig. 6-Infrared absorption curves for ethane, methane and ethylene.

method used in obtaining an optical balance in the instrument can also help in eliminating interference. (6) Whole regions of the spectrum can be eliminated by the use of the proper filters, such as CaF<sub>2</sub> windows, quartz windows on the cells, or a single filter of these or other materials.

This does not exhaust the possibilities, as combinations of these methods could also be used. Usually there is more than one combination of factors which can be made to work. At present these are discovered more by educated trial-and-error methods than by any nice scientific approach. They do work, however. Some of the applications of the analyzer of Figs. 4 and 5 (see the accompanying table) are on mixtures with as many as 13 components. Fortunately, some of the interfering components are in low concentrations, so that they can either be neglected, or relatively low concentrations of them in the interference cell will prevent trouble.

These sensitization procedures are not peculiar to the negative-filter instrument, but also must be done for the positive-filter type also.

### COMMERCIAL INSTRUMENTS

The instrument manufactured by Baird Associates is shown schematically in Fig. 5a, and the components comprising its optical system in Fig. 5b. The sample cell is readily removed from its case for cleaning. The two

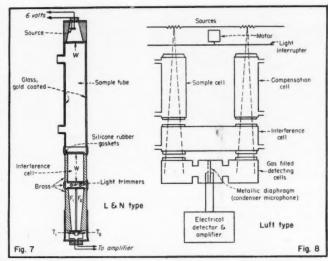


Fig. 7—Another negative-filter analyzer (L&N) shows different design features. Fig. 8—Diagram of Luft's analyzer, forerunner of modern positive-filter type.

components on each side of the sample cell are screwed to the sample cell compartment and enclosed in cases. The cells may be of brass or stainless steel, depending on the application; and the cell windows of quartz, calcium fluoride, rock salt, etc., again depending on the problem. A single mirror in the source compartment serves to align the two beams. The optical unit is enclosed in a copper box, which in turn is placed in an insulated explosion-proof box. This.

along with the recorder and amplifier, is shown in Fig. 4.

Another instrument of the negativefilter type is that of Leeds & Northrup Co., shown schematically in Fig. 7. The instrument is similar to the Baird type but there are considerable differences in the instrumental components. Thermopiles are used instead of bolometers and an attempt has been made to funnel the energy from each beam on to the respective thermopiles by cone shaped filter and compensator cells F<sub>1</sub> and F<sub>2</sub>. The gold coated borosilicate glass sample cell constitutes a similar attempt to conserve energy.

The first positive-filter type instrument is shown in Fig. 8. Developed by K. F. Luft in 1943, it is the forerunner of all modern "positive-filter" type instruments. Because the general arrangement is typical of a number of instruments produced by different manufacturers, the name Luft-type Infrared Analyzer (i.e., LIRA) has been given to them. The instrument has an interference cell and a compensator cell as shown. A characteristic of this instrument common to all commercial positive-filter type instruments is the light interrupter. In this particular instrument, the two infrared beams from two Nichrome wire spirals are chopped simultaneously and an amplifier is tuned to respond only to the frequency of interruption. This

# A Limited List of Applications\* for Non-Dispersive Analyzers

Measured Component	In Presence of	Range, Percon
Acetone	Air	0-2
Acetylene.	HCN	0-25
Acetylene	Mixed hydrocarbons, CO, CO2, air, water vapor	0-10
Ammonia	CH4, CO3, air, H2O	
Benzene	Air, CO2, water vapor	0-5
Benzene	Toluene-air mixture.	
Iso-butane	Mixed sat. hydrocarbons	0-20
n-Butane	Mixed sat. hydrocarbons	
Carbon dioxide	Air	0-0.5
Carbon dioxide	CO and water vapor	
Carbon dioxide	Six components, hydrocarbons and water vapor	0-5
Carbon monoxide	CO2, CH4, air, water vapor	
Ethanol	Water vapor and air	
Ethylene	Methane, ethane	0-20
Ethyl acetate	Toluene-air mixture	
Hydrogen cyanide	Acetylene	
Methane	Nat. and illum. gas mixture	
Methane	13 components, hydrocarbons and air	
Methane	Annealing furnace atm	
Methyl chloride	Ether	
Monovinyl acetylene	11 components, hydrocarbons, water vapor, air	
Sulphur dioxide	Air	
Water vapor	N <sub>2</sub> , CO, CO <sub>2</sub>	

\*Notes on Table—This list is meant only to illustrate the wide range of uses of the analysers and implies nothing regarding limitations. As far as possible actual plant applications have been used, but in one or two cases where potential application and be reliably forceast, these have been added to round out the picture. The range figures are for full scale recorder readings—wider or narrower ranges can be used without difficulty. Sensitivity figures are not given since these depend on the application and length of absorption cell, but they range down to 50 ppm. or less, depending on the composition measured. Any gas or vapor which affects the cell windows can cause trouble, but different, unaffected window materials can often be used, e.g., water vapor affects rock salt windows, but calcium fluotide gives satisfactory results.

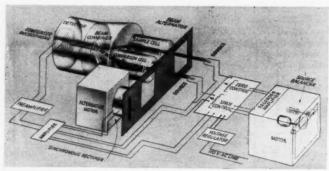


Fig. 9-Diagram of modern positive-filter instrument, the M.S.A. LIRA.

modulated system increases considerably the stability of the instrument, and additional freedom from ambient temperature effects is obtained by providing a slow leak between the two halves of the detector cell.

The instrument shown in Fig. 9 is another Luft-type instrument, manufactured by Mine Safety Appliances Co. Two Nichrome wires provide the two sources of radiation. One beam traverses the sample cell and the other the comparison (compensator) cell as shown. The emergent radiation is converged into the single detector cell by a beam combiner which consists of two cylinders in the form of a V.

Between the sources and cells, a reciprocating metal slider alternately blocks the radiation to the sample cell and to the comparison cell. The amplifier is tuned so that only variations in light intensity occurring at the alternating frequency produce an output signal. Therefore, when both beams are equal in intensity the output is zero, there being no change in the condenser microphone capacity. When the gas to be analyzed is introduced into the sample cell, it reduces the intensity of radiation in that beam and the two beams become unequal. This sets up a signal at the condenser microphone, which is amplified, rectified and passed to a servo-mechanism, which does two things. It causes the pen of a recorder to move, and it causes a reduction in the voltage applied to the comparison beam source. The pen of the recorder moves until the intensities of the two beams at the detector are the same, at which point it stops and gives a measure of the concentration of the analysis component.

The use of a single detector in this instrument minimizes zero drift and

gives high internal stability in the instrument.

# POSITIVE VS. NEGATIVE TYPES

In comparing the two general types of instrument, many of the differences are mainly due to what each manufacturer believes is the best approach to satisfy plant conditions. The present instruments of Baird Associates and L&N have no moving or vibrating parts in key positions, on the theory that this makes for ruggedness. Detectors based on the heat expansion of gases, as in the positive-filter type instruments, may have linearity problems, but this may not be serious, as the temperature differential would be small. On the other hand, the detectors used in negative-filter type instruments have a lower signal-to-noise ratio. The positive-filter type of instrument is definitely limited in analyzing liquids, as a suitable sensitizing gas must be used in the detector, but such a gas or mixture of gases could probably be found for many applications. Application to liquids is relatively simple in the negative-filter type, but thermostating at a sufficiently low temperature for some liquids might cause trouble and a chopped beam system might be more feasible for protection from ambient temperature.

One of the advantages claimed for the positive-filter instruments is that there is zero background signal, whereas, in the negative-filter method there is a large background signal—i.e., a large amount of the radiation detected is not directly concerned in the analysis. This is quite true for simple gas mixtures, but for complex mixtures the background signal in the negative-filter instrument gets smaller due to the high absorption of the other

components and the desensitizing gases used, and ways could be found of climinating it altogether.

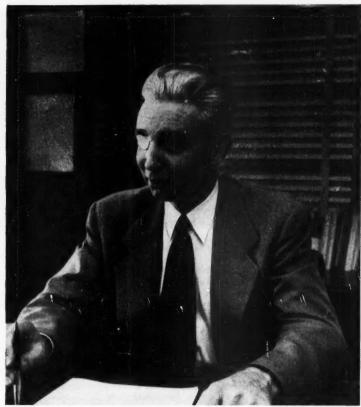
At present, positive-filter instruments are considered more sensitive for some applications than the negative-filter type, but here again this is not basic to this type of instrument. It depends primarily on the detector, and the fact that longer cells are available in these instruments. For some applications, where lead sulphide cells could be used, the negative-type would be very much more sensitive.

It is more difficult to get rid of interference in the true positive-filter type instrument, as to do this effectively both beams should pass through the sample cell. When this necessity arises, then a filter cell similar to that used in the negative-filter type is inserted. The instrument then partakes of both types. This is the system employed by the Mine Safety Appliances instrument for some applications. There is one relatively new instrument, the Cary, which uses two gas microphones, and two separate detector cells, which may meet this problem.

# ANALYZERS VS. SPECTROMETERS

For plant process analysis and control the non-dispersive infrared analyzers have a number of advantages over infrared spectrometers, including greater ruggedness and stability, lower cost, and elimination of mathematical treatment for interfering bands. In addition they are more sensitive, detecting smaller concentrations of a given component in a given path length-because of their use of the integrated energy of the entire infrared absorption spectrum of the component. And because they have no slits or dispersing elements, they have theoretically infinite resolution, giving greater selectivity. They have shown measurable and significant differences on gas mixtures with apparently identical infrared spectra.

All this adds up to a decidedly useful instrument for chemical plant analysis. With the development of liquid analyzers, their potential seems unlimited. To reach this potential means further improvements and better knowledge of sensitizing and desensitizing, as well as of application in the plant. Properly used, such instruments can not only give continuous and instantaneous analytical results, but often can control the process as well.



ANDY STOKES talks "off the cuff" and hands out some straight dope about today's. . .

# Market Research & Market Development

It was hot the day we sat down in Sid Kirkpatrick's office with Andy Stokes to kick around this subject of market research and market development.

And Andy had promised to make it even hotter. He said that many people doing market research today are "spinning their wheels without getting anywhere." He is also keenly aware of the obligations taken on by the people who do market research and market development he told us—for he learned his lessons the hard way.

"The result," he said, "is that on my conscience you'll find worries about misdirected research projects and wasted funds—simply a case of not knowing where you're going, failing to ask, "Why am I doing market research and what do I hope to get out of it?"

DR. C. A. STOKES has been Director of Research and Development for Godfrey L. Cabot since 1945. He ruefully confides that he is sorry someone else didn't write an article along these lines seven years ago.

"I suspect," he continued, "That many top management executives don't stop to think just what the words market research and market development mean—or if they're really conditioned to take on the responsibilities that go with these functions. So if you fellows want another article praising market research and the market researcher, you've got the wrong man. My thought is to let go both barrels—maybe torpedoing a few pet ideas that people have about market research and market development. Think it'll make good reading?"

We thought it would, so we listened attentively, wrote furiously and cussed the colleges for not teaching shorthand.

Godfrey L. Cabot's Director of Research and Development, meanwhile, gave forth on one of his favorite subjects while Syd Karson, our photographer punctuated with flash gun and recorded with Rolleiflex some of the significant points coming out of our interview.

You'll find the whole story on the following pages.

# To Really Do Market Research, Stokes Says . . .



# Get all your "brass" into the act.

It seems to me that the market research and market development functions are overlooked, misused or not used at all in many companies.

I think there are two reasons that explain why.

The first is that many executives simply do not know what the words mean. Secondly, they don't have a clear idea of the obligations they take on when they decide to carry on these functions.

Why is this so? Well part of the explanation is the fact that market research people go to meetings and talk to other market research people instead of staying home and doing a selling job on their own management.

If you've got an educating job to do, begin right now. Start with first things first. If your management and colleagues are in the kindergarten stage of market research knowledge, don't send them PhD.-level dissertations on methodology or on the fine points or organization of market research and market development activity.

Instead, start by getting across a clear concept of what the words "market research" and "market development" mean. (Stokes paused here to make it clear that he was talking primarily about market research and market development as these functions relate to finding markets for new products—new-to-the-world-products, not merely products new to a given company's sales line.)

Market research is an attempt to find out what the size and nature of a market might be. It does not find out what the market is—that's something only actual experience will tell you. Rather, market research should answer questions of the sort, "What might the market be if . . .?"

The "ifs" put certain qualifications on the answers.

You might be making a specific product when you begin your market research, but very often you're not. If the product is in existence at all there are usually only small quantities available—enough to measure physical and chemical properties and maybe enough for a very small amount of applications research.

If there's enough for wide distribution, then you could



# Tell what they're getting into and why.

enter the market development phase-but more on that later.

In either case, the type of product would almost always be known, and the more specifically defined, either by hopes or data, the more specific can be the answers concerning what the market might be.

The next thing to do is get across the idea that you've got to take on certain obligations when you get into market research.

For instance, suppose you wanted to find out whether it would be wise to try to develop a new reinforcing filler for rubber.

You could make a few dozen pounds of prospective product, send it out to a few customers asking them to let you know if it were any good. That's opportunism. You hope your prospective customer will do some fairly extensive applications research for you and report the data in finished form certified for re-use on your next prospect!

But then what happens if he finds out you never seriously intended to make the product—or to sell it at competitive prices? You've probably lost a friend and a customer and you've given your company a black eye.

Another approach would be to try to estimate what the market might be if . . . in 1960 the producers were still using synthetic and natural rubber in the same proportions as they are today. Then all you'd have to do is make some extrapolations.

But if you really wanted to do a job, you'd choose this third approach.

In effect you'd have to set out to explore the minds of the leaders in the rubber industry by asking these types of questions: "What types of rubbers do you think might be used in 1960?"—"What are the trends in compounding that would indicate a use for the new type reinforcing filler?" etc. etc.

These men might answer "Why should I risk telling my competitors through you what I think?"

# Then, to Develop the Markets, You've Got to . . .



# Strictly define your objective.

There's where the acceptance of the responsibilities of market research comes in. If you've got a reputation for being honest and ethical, for keeping your information confidential, or publishing it only in anonymous form, for following through by sharing the data with those who have helped you collect it—then you'll have no trouble getting the best available answers and thereby doing the best job that it is reasonable to expect. That's the idea you have to sell to management.

Now what about this idea of market development? Again, let's start out by telling what the words mean.

The job of market development is to substitute for some "might be" answers, more definite statements like:

The market will be about 10,000,000 units per year at a price of 15 to 20¢ per unit for a product within specifications a, b and c for uses x, y and z, beginning at the rate of 1,000 units per month within a year and increasing at the rate of 1,000 units per month; this has been substantiated by tests made to the satisfaction of or by the prospective buyers. (This is, of course, the ideal answer—real cases may leave a little more to be desired.)

It will be realized that the amounts to be consumed and timing of sales are still only close approximations.

In developing a market for a product there are even more stringent obligations than in doing market research. Here you imply that:

First, the product has been produced or is being produced by a proved process making a consistent product.

Second, the product is being produced at rate r and there is enough uniform quality material on hand to meet all reasonable obligations for sample distribution.

Third, samples are available up to quantity s at price schedule t.

Fourth, you plan definitely to produce the product at a higher rate for sale within price range w. There need be no firm promise to produce; the supplier cannot be expected to commit himself to this extent. However, it's no more than good faith to expect that there is a definite



# Demonstrate ethics, good faith.

plan for commercial or semi-commercial production and sale of product if the development program pans out.

If management and the research director are not willing to agree on these four obligations, they are in real danger of misunderstanding what they're doing and they may unduly mislead the prospective buyer. Market development efforts made without a clear understanding of implied obligations may lead to situations like that of the little boy who cried "Wolf!"

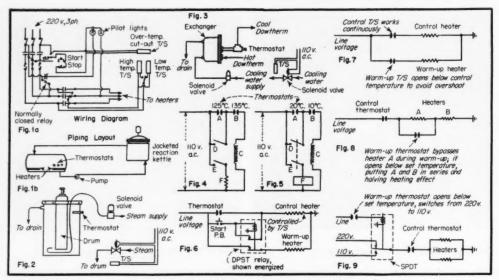
Let's wrap it up with a case in point, which will prove, by the way, that I'm only offering suggestions—I don't pretend to know all the answers.

Some time ago, I showed a sample of a new organic compound, developed in a search for organic plasticizers, to a sales executive, asking him what he would do with it.

"Well," he replied, "I'd give samples to three or four selected customers and if they found it did a wonderful job in such and such resin, fine—if not, well then I guess it wouldn't sell."

Now, in the name of reason, let's take a little more broadminded view of the case. This compound is, first of all, an organic chemical, and incidentally a good plasticizer because we honestly were trying to make one. This class of organic chemical—high boiling, stable, moderately viscous liquid—has, in general, the following types of uses, to name only the ones I can think of off-hand: (1) plasticizer for plastic film, thermoplastic molding compounds, protective coating resins, rubbers; (2) lubricant; (3) hydraulic fluid; (4) insecticide or insecticide carrier; (5) coolant fluid; (6) intermediate for organic synthesis; (7) specialized solvent.

Looked at as a plasticizer, we have to remember that there are eight or ten or more commercial varieties of resins needing plasticizers—resins ranging in uses from the manufacture of paper thin, flexible, unsupported film to injection molding. Each resin has innumerable uses and new ones being discovered every day. The same is true (Continued on page 148)



NINE HOOK-UPS portray many different ways of using thermostats for temperature control.

# Make the Most of Your Thermostats

Did you realize that simple thermostats can often substitute satisfactorily for more complex controllers? The author, who uses them in pilot plant work, here details six varying types of use.

# IRVING H. COOPER

The versatility of small thermostatic controls is sometimes overlooked. Their most common use has been for maintaining a heated system at a single constant temperature. However, with a little thought this range of usefulness can easily be extended to at least several other types of applications. For example, by using combinations of thermostats we can obtain temperature control systems having any of the following characteristics: (1) Different temperatures in various parts of the heated system; (2) operation within a given range of temperatures, rather than at a single, fixed temperature; (3) fast warm-up with little overshoot; and (4) operation at selected tempera-

I. H. COOPER, who will be remembered as the winner of our May 1952 Plant Notebook contest, is a project engineer in the chemical research division of Heyden Chemical Corp., Garfield, N. J.

tures at successive times in the reaction.

Moreover, thermostats have been found highly useful as high-heat and low-heat safety cuts-offs in installations where the protection of equipment and personnel must be provided along with temperature control.

In our pilot plant we have built a number of heated systems in which we solved temperature control and heating problems similar to those enumerated above and have had considerable success with the cartridgetype thermostat such as those manufactured by Fenwal Inc. Thermostats of this type have been found to provide the desirable combination of high sensitivity, resistance to shock and vibration, compactness, and a wide adjustable temperature range. Here are a few illustrative examples.

# 1. Circulating Oil Heater

This heat exchanger was to be used in conjunction with a reaction kettle for the carboxylation of a dye intermediate. The hot oil, heated with three 5-kw. heaters, was circulated from the heat exchanger to the jacket of the kettle with a centrifugal pump.

We desired to investigate the reaction at two temperatures, 325 and 425 deg. F. Also, we wanted an automatic cut-off device to prevent overheating. To do the job, we inserted three cartridge-type thermostats through the boiler wall into the oil, as shown in Fig. 1b. One thermostat was set at about 425 deg. F., the other at 325. These two thermostats were connected through a two-position selector switch so that we could change from one process temperature to another as in Fig. la. Because of the current loads involved, suitable power relays were inserted between the thermostats and the heaters. The third thermostat. the safety cut-out, was placed in series with the two controllers and was set to break the power circuit if the temperature exceeded 450 deg. F. This

thermostat operated a manual-reset relay so that the heaters would not be restarted until the cause of overheating was determined. At the same time, the relay operated amber (operating) and red (overtemperature warning) lights on the control panel.

The thermostats were placed in the boiler rather than in the kettle jacket to minimize lags in temperature response. Lags can be kept to a minimum when the thermostats are placed close to the heaters, because temperature variations are sensed at the source rather than at some distant point. The convection cooling in the circulating lines was easily offset by turning the thermostats up a few degrees to obtain the required kettle temperature.

# 2. Pipeline Reactor

An experimental continuous reactor of the jacketed pipeline type in which thermostats were used successfully to control different temperatures in several zones has already been described in detail. (See author's prize winning Plant Notebook article, p. 222, July 1952). Each zone in the reactor was individually temperature-controlled by use of circulated hot water, with a thermostat in the line at the end of each zone. The thermostat was connected to a double-throw relay which either admitted cold water to the system if the temperature was high, or connected an immersion heater if the temperature was low. This enabled us to maintain temperatures within about ± 1 deg. C.

# 3. Liquefied Gas Vaporizer

Some of the gases we use come to us liquefied in standard cylinders. To vaporize the gas before use, we commonly immersed the cylinder in a water bath heated by a steam line. On one occasion, the temperature controller, which normally regulated the bath temperature, failed in the open position. This caused the bath temperature to rise to the extent that the gas vaporized at a faster rate than we could pipe it off. The resulting pressure developed in the cylinder blew out the fusible safety plug.

Following that experience, we installed a cartridge thermostat in the bath to act as a safety cut-off as shown in Fig. 2. We arranged it so that, should the bath temperature rise to an excessive level, the thermostat would open and cut off the power to a sole-

noid valve in the steam line, shutting off the steam. On several subsequent occasions, when the main controller failed or was set incorrectly, the action of the safety overheat thermostat has cut off the heat and prevented loss of the gas, and, possibly, more serious consequences.

# 4. Dowtherm Cooler

We are occasionally troubled with freeze-ups in the heat exchanger of a circulating Dowtherm cooling system because of excessive cooling by tap water. To alleviate this difficulty without sacrificing cooling capacity, a thermostat is to be installed in the Dowtherm line, immediately after the heat exchanger, set at about 5 deg. C. above the Dowtherm freezing point. Then, should the Dowtherm temperature get too low, the thermostat will operate a solenoid valve to shut off the cooling water until the temperature rises to a safe level. See Fig. 3.

# 5. Adjustable Differential System

A pair of thermostats can be used to obtain an adjustable differential in either a heating or cooling system. These set-ups are useful for conserving equipment and current by eliminating frequent cycling of heaters or cooling equipment when maintenance of a specific temperature is not critical. Fig. 4 shows a typical arrangement for maintaining a kettle heating system between the limits of 125 and 135 deg. C. A pair of thermostats, one at 125 and the other at 135 deg. C., is installed in the heat exchanger. The thermostats, both of the type that opens on temperature rise, are connected with a double-pole, singlethrow, normally open relay. At and below 125 deg. C., both thermostats are closed, allowing the current to pass through relay coil C. This closes the relay contacts D and E, putting the heater F into operation. When the temperature just exceeds 125 deg. C., thermostat A opens but, because thermostat B is still closed, the relay contacts remain closed and continue to supply current to the heaters. When the upper temperature limit is reached, thermostat B opens and de-energizes the relay. This cuts the heaters off until the heat exchanger temperature falls below 125 deg. C. Thereupon, both thermostats again close, energize the relay, and put the heaters back into operation.

Fig. 5 shows a similar arrangement for obtaining a differential in a cooling system, in this case, between 10 and 20 deg. C. The principal difference in the set-up is the use of thermostats which close, rather than open, on temperature rise. As above, the thermostats are connected with a doublepole, single-throw, normally open relay. Above 20 deg. C., both thermostats are closed, causing the relay contacts D and E to close, and putting the cooling unit F into operation. At temperatures between 10 deg. C. and 20 deg. C., thermostat A is open, but thermostat B remains closed, allowing current to continue to pass to the cooling mechanism. When the system falls to 10 deg. C., thermostat B opens, shutting off the cooling system. Cooling begins again when the temperature again exceeds 20 deg. C.

# 6. Rapid Warm-Up

Rapid warm-up can be achieved without appreciable overshoot in electrically heated ovens, platens, and similar types of equipment by using a pair of thermostats to control the heaters. Several possible circuits for wiring the heaters are shown in Figs. 6-9. In these circuits, the rapid warm-up is achieved by allowing all heaters to operate (or to operate on higher voltage) when the equipment is first switched on. The warm-up thermostat controls the high-wattage heaters and is set to shut them off (or reduce the voltage) when the system approaches the desired control temperature. The temperature at which this thermostat should be set can best be determined with a few trial settings. The optimum cut-off temperature is one which brings the system as closely as possible to the final control temperature with minimum overshoot.

The second thermostat is, of course, set at the temperature to be maintained in the system. Fig. 6 is unusual in using a single thermostat which cuts out both heaters at the set point, then controls only the control heater. The heaters which maintain the system at the control temperature can be of appreciably smaller rating than the warm-up heaters, because the control heaters must only replace the heat lost by process absorption, convection, and similar small losses. For this type of installation, the cartridgetype thermostat will render excellent service.

# Editorial Viewpoints

# Profitless Prosperity?

Since the war corporation profits after taxes have ranged between 8.1 percent of the gross national product in 1950 and 5.8 percent in 1951. This year they will probably fall to around 5 percent, according to estimates of Dr Lionel Edie. Yet over a period of years they have averaged 6.6 percent. This means, then, that relative to the business volume of the country, present-day profits are at recession levels. Doubtless there will be some temporary rebound from the effects of the steel strike. But the correction might better come from individual industries and companies through further increases in operating efficiency. That is the engineer's answer to "profitless prosperity."

# New Patent Law Will Help

Recent revision of the patent law promises to give substantial encouragement to research on new uses for old chemical compounds. This and several other advantages result from the enactment of Public Law 593 of the 82nd Congress, an act approved by the President on July 19.

It now seems likely that patents will be granted much more readily on new uses of old compounds. In effect, the new law says that if an old compound is identified as having a new and important application not obvious from its known chemical characteristics, then identification of that use is a patentable invention.

Another interesting change sets aside the famous 1941 decision of Justice William O. Douglas, which declared that an invention, to be worthy of a patent, had to be the result of a "flash of creative genius and not merely the result of the skill of the calling." According to the new law, it is immaterial whether invention results from long toil and experimentation or from the flash of genius.

Also for the first time the law spells out the principle that a court must presume that a patent is valid once it is granted by the patent office. Too often in the past, courts have assumed that no patent is valid unless the inventor has proved by litigation that he has a right to it.

It is encouraging that the Congress found time during a busy session to undertake these real improvements in the patent law. The fact that most of the improvements relate to procedure does not detract from the interest of the chemical engineer and research director in this new legislation. It is to be hoped that the courts will not unduly restrict the application of the act as controversies inevitably develop. It is also to be

hoped that abuse of the new privileges will not bring the whole matter into discredit in the courts.

# A Self-Discredited Report

"It is one thing to raise an alarm; it is another thing to put out the fire." So writes Representative Thomas G. Abernethy in a scathing criticism of the majority report of the Delaney Select Committee on the use of chemicals in foods. He is joined by his colleague, Hon. Walt Horan, in the conclusion that the committee's report is "alarmist" in nature, that it adds to the difficulties of the food producer, at the same time contributes nothing of assurance to the consuming public.

The minority report cites chapter and verse to show where technical testimony had been distorted in several conspicuous efforts to prove certain preconceived ideas with which some of the committee and its staff started their investigation. This is most unfortunate. It cannot help but discredit the main conclusion and recommendation of the entire committee, namely, that "the Food, Drug and Cosmetic Act be amended to require that chemicals employed in or on foods be subjected to substantially the same safety requirements as now exist for new drugs and meat products. Adequate provision for a comprehensive, judicial review of administrative decisions should be included in such an amendment."

We find little ground for dissent with that recommendation. But we also agree strongly with the final conclusion in the Horan-Abernethy reports: "We need faith in Government. We need both a feeling of security and encouragement in the hearts of our producers. We should assure the security of the consumer. Our Government is doing that. Let us admit it."

Why then should a Committee of Congress undermine that faith by failing to recognize the responsible work of the Food and Drug Administration, the Public Health Service, and the Department of Agriculture? Surely the public that has paid for these costly investigations is entitled to some assurance that its interests and safety have been and will continue to be protected.

# Johnson Makes the Team

A few weeks ago we received a comic book in our mid-morning mail. Its four-color flashy cartoons and its title, "Johnson Makes the Team" struck our eye, made it stand out in stark contrast to our usual volume of sober correspondence and drab releases.

But this comic book-put out by B. F. Goodrich

Co.—was something different. It sells, not the company or its products, but the spirit and fruits of free, competitive enterprise. Its audience: some 3,000,000 students in upper grades, junior and senior high schools.

Goodrich's cartoonists used all the tricks of their trade (and they are legion) to catch the interest and imagination of a teen-ager. Basic economic facts are kept on the firm ground of reality, yet they are made as gripping to an adolescent's receptive mind as the exploits of Space Cadet.

The spirit of competitive enterprise will perhaps burn a little brighter in our own children, the leaders of tomorrow, because Goodrich's Johnson made his team.

#### Rewards for "Captive Inventors"

Moot question in many organizations is whether the salaried researcher is entitled to special rewards for inventions made in line of duty. Although there is no established uniformity of practice in industry, most companies follow a fairly liberal policy in this matter. They have found through experience that suitable rewards not only encourage inventions, but stimulate morale and "patent-consciousness" among employees. Our government, on the other hand, has been slow to adopt any comprehensive plan for research incentives—this despite the fact that Uncle Sam is today the largest single employer of laboratory scientists and engineers.

As the first move toward correcting this situation, an inter-agency committee appointed by the chairman of the Government Patents Board has just published a report entitled "A Proposed Government Incentives, Awards and Rewards Program With Respect to Government Employees." It discusses and analyzes the problems involved in such a program, examines already existing laws, and compares them with the practices and experiences of American industry and of such foreign governments as Great Britain, France and Sweden.

In his foreword to this booklet, Dr. Archie M. Palmer, chairman of the Government Patents Board, expresses hope for (1) new legislation providing the necessary comprehensive program and (2) immediate steps to make fullest use of existing statutes for rewarding government employee-inventors. But he recognizes that there are arguments pro and con that must be considered in the further development of such a program. He therefore invites your critical study of the committee's report (obtainable for 15 cents from the Government Printing Office).

The only possible danger we see in this project is the additional incentive for government workers to neglect fundamental research in favor of patentable inventions. Further invasion of the legitimate field of industrial research is not in the public interest, as we see it. Yet it should be possible to set up a program that would reward important non-patentable as well as patentable contributions to science and technology.

#### The Show Goes On

Death by cancer of Senator Brien McMahon of Connecticut closed a short but most significant career of public service. In the seven years since the first bomb exploded over Hiroshima, he was more responsible than any other man for the organization and success of the atomic energy program. That he did not live to see the full realization of his dreams for broader peacetime applications of this great energy source is most unfortunate.

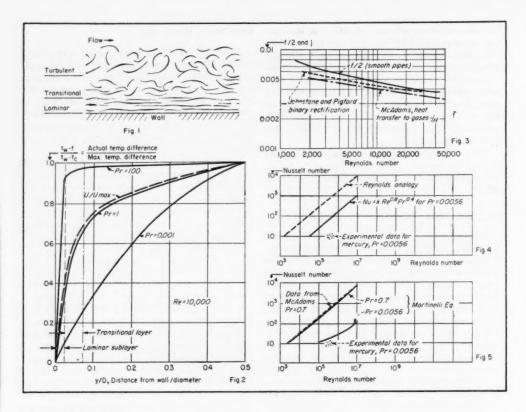
Yet, only a few days before Senator McMahon died, the Atomic Energy Commission had issued what is regarded by many as the most optimistic report in its history. For the first time, it would seem that adequate raw materials are in sight for a greatly expanded program of peacetime as well as military projects. Substantial accomplishments were noted in research and process developments of interest to industry.

At least one team (Dow Chemical-Detroit Edison) of the four industrial groups that have been surveying the possibilities for private enterprise in the field of reactor technology has received the Commission's approval for a feasibility study of a particular type of dual-purpose reactor capable of producing both fissionable material and electric power. The three other groups—Monsanto-Union Electric, Commonwealth Edison-Public Service of Northern Illinois, and Bechtel-Pacific Gas & Electric—have all filed their final reports and await Commission approval of their recommendations. A new contract with the Carborundum Co. to supply zirconium and hafnium is another significant step in encouraging private enterprise to take over work that AEC formerly had to do itself.

So the program Senator McMahon first visualized and fought for in 1946 moves steadily ahead. His guiding influence, energy and enthusiasm will be missed. But it is encouraging to note that the Joint Committee of the Congress has almost always had the complete support of both political parties. This is as it should be for atomic energy is truly a national resource.

#### We Thank You

Vol. 1 No. 1 of this magazine's predecessor, Electrochemical Industry, carried a Philadelphia date line of Sept. 1, 1902. This month, therefore, actually marks our fiftieth birthday, although we celebrated the occasion a bit prematurely, but most enthusiastically, in our July issue. That anniversary volume, dedicated to the "Builders of the Chemical Century," has brought us several hundred interesting and intimate letters from old friends among readers and contributors of this magazine. For all of these we are deeply grateful. To each of our correspondents we have sent a separately bound reprint of the special section on the history of our profession and its future problems. There is a copy waiting for you, too, if you will ask for it.



Re, Pr, Nu, St, Pe . . .

## What's Their Real Significance?

Dimensionless groups are more than just good tools for correlating heat-transfer data. An understanding of what they really mean can provide the key to many unusual heat-transfer problems.

#### J. J. CARBERRY

Engineering design problems can be divided into two general categories according to their modes of solution. On one hand are those problems susceptible to immediate mathematical analysis by the application of known physical laws.

In the second class are those systems which defy exact mathematical analysis. The design of heat-transfer apparatus may be placed under this heading. Here the number of variables involved is large and exact correlation difficult. Though the important variables are recognized, lack of a rigorous comprehension of the mechanisms of thermal transfer makes the design problem complex.

We can take recourse, however, in the concept of similarity. This concept holds that certain variables in any system can be combined into dimensionless constants, which constants are the same in any similar system. Geometric similarity is found when the ratio of linear dimensions in one system equals that in another system. Force and physical properties can be correlated in like manner.

For example, the nature of fluid flow, whether streamline or turbulent, is a function of pipe diameter D, linear velocity U, density  $\varrho$  and viscosity  $\mu$ . Prediction of the nature of flow in any system is possible only when these variables are combined into a dimensionless group, the Reynolds number  $DU\varrho/\mu$ . Heattransfer data for fluids in turbulent

JAMES J. CARBERRY is a chemical engineer at Du Pont's Eastern Laboratory, Gibbstown, N. J. He is a 1951 M. S. from Notre Dame.

flow are generally correlated in terms of dimensionless groups by the expression relating the Nusselt, Reynolds and Prandtl moduli as follows:

 $Nu = Z Re^a Pr^b$ 

where Z, a and b are constants.

#### DIMENSIONLESS GROUPS

In general, the variables are assembled into dimensionless groups by the methods of dimensional analysis. All of the known variables in a system may be related in terms of four fundamental units-length, mass, time and temperature. The most significant dimensionless groups have traditionally been named in honor of pioneer scientific investigators.

The numerical values of the exponents and coefficients in dimensionless equations are determined by correlation of experimental data. Dittus and Boelter,\* for example, found that a vast amount of such data for turbulent heat transfer was correlated by

$$Nu = 0.0254 Re^{0.8} Pr^{0.35}$$

Colburn later extended the correlation to cases of turbulent flow of fluids through pipes, across cylinders and across flat plates by the equation

$$(St) (Pr)^{2/3} = j = \Phi Re^{-4/3}$$

where the Reynolds function is different for each system.

The dimensionless groups in these heat-transfer correlations are Nu = hD/k = Nusselt number, St =  $h/GC_p$  = Stanton number, Pr =  $\mu C_p/k$  = Prandtl number and Re =  $DU_{\varphi/\mu}$  = Reynolds number; the dimensional variables are h = heattransfer coefficient, D = diameter of system, k = thermal conductivity, G = mass velocity based on area perpendicular to direction of flow, C, = specific heat at constant pressure, µ = viscosity, U = linear velocity and o = density.

#### ADVANTAGES AND LIMITATIONS

Dimensional analysis and the subsequent correlation of data in generalized forms have greatly simplified otherwise complex problems. However, like all simplifications, there are hazards involved. Primarily, the basic significance of the various dimensionless moduli is obscured-which limits our insight into the fundamental problems.

Further, such generalizations are far from universal. The ones cited are limited in applicability to only the apply, for example, to fluids of prime importance in nuclear reactor development, such as mercury and mol-

Efforts are being made to obtain broader heat-transfer relations. The ultimate goal of such work is the elevation of heat-transfer design into the class of engineering problems susceptible to exact mathematical analysis. Since this requires the "application of known physical laws," the immediate object of research in this field has been the study of the fundamental mechanisms involved. The rest of this article is devoted to a review of some significant aspects of this work.

Inasmuch as heat transfer and fluid flow are so closely interrelated, a brief review of fluid flow phenomena is in

Consider the most common instance, that of a fluid in turbulent flow. Three distinct regions of fluid motion have been postulated (Fig. 1). In the main body of the fluid a state of complete agitation exists, characterized by random mixing of the masses of fluid. An irregular variation of fluid velocity at a point is found here, resulting in a transfer of momentum from one point to another.

The transfer of mass from the center of the conduit toward the wall is rapid in this region; this phenomenon has been termed "eddy mixing" and the swirling masses termed "eddies."

By contrast, adjacent to the retaining wall laminar flow is said to prevail. Within this "film" there is no radial mass flow or mixing; here the transfer of momentum occurs only by the slow process of molecular diffusion.

In the intermediate buffer or transitional region, postulated by Von Karman,30 both turbulent and molecular diffusion occur.

#### MOMENTUM EXCHANGE

Fluid friction is actually this transfer of momentum due to shear stresses existing between the fluid and its retaining wall and between adjacent lamina of fluid. In the laminar sublayer, this stress is termed viscous shear, and the resulting rate of momentum transfer v, may be expressed

 $\tau_1 = (\mu/\rho) (dG/dy) = momentum/(h\tau.) (ft.2)$ where  $\mu/\rho = \text{kinematic viscosity,}$ G = momentum per unit volume and

more common fluids. They do not y = distance perpendicular to the flow axis. The kinematic viscosity is, therefore, a coefficient of momentum transfer due to viscous shear.

Within the turbulent core, the rapid momentum transfer can likewise be expressed by a rate equation

$$\tau_i = E dG/dy$$

where E = coefficient of turbulent momentum exchange.

This eddy coefficient E is to turbulent momentum transfer what the diffusion coefficient D. is to molecular mass transfer. The rate of mass transfer is given by

$$R = D_v dc/dy$$

where dc/dy is the concentration gradient. The diffusion coefficient D. is proportional to the molecular mean free path times the molecular speed.

By analogy, then, the eddy coefficient may be defined as the product of the mean free path of an eddy times the eddy velocity. The mean free path of an eddy has been termed the mixing length, or the distance an eddy travels before losing its identity by mixing with other eddies. This mixing length L has been indirectly determined as a function of distance from pipe centerline to the retaining wall. Under conditions of turbulent flow, L varies from zero at the wall to 14 percent of the pipe radius at the centerline. Therefore, L is a direct function of pipe diameter at a given turbulent flow

The velocity of an eddy is that of the instantaneous fluid velocity component perpendicular to the retaining wall. This point velocity v is a function of main stream velocity. Hence:

$$E \propto vL^*$$

$$\tau_i = (vL)dG/dy$$

The total rate of momentum transfer through the core, due to viscous and eddy forces, is then as follows:

$$\tau = (\mu/\rho + E) \frac{dG/dy}{dG/\rho} 
= (\mu/\rho + vL) \frac{dG/dy}{dG/dy}$$

#### DERIVATION OF REYNOLDS NUMBER

Dividing the coefficient of eddy transfer E by that of viscous transfer  $\mu/\rho$  we get  $E/(\mu/\rho)$ , or  $L\nu\rho/\mu$ .

Since L is a function of D, and v is a function of U. then

Le 
$$\rho/\mu \cong DU \ \rho/\mu = \frac{turbulent forces}{viscous forces}$$

<sup>•</sup> Actually defined by Prandtl as  $E=L\ dU/dy$  where  $v \propto dU/dy$ .

This modulus is named the Reynolds number in honor of Osborne Reynolds, a brilliant engineer of unusual insight and imagination. In 1874 Reynolds suggested that in geometrically similar systems heat and momentum were transferred by the same mechanism.

The Reynolds analogy states that the transfer of heat in the turbulent layer is an eddy transport phenomenon and can be expressed in terms of area A perpendicular to heat flow as

$$Q/A = C_{p\rho}E \ dT/dy$$

where dT/dy is the radial temperature gradient and E, the eddy heat-transfer coefficient, has the same numerical value as the eddy coefficient of momentum transfer.

The analogous expression for heat conduction in the laminar sublayer is

$$Q/A = k dT/dy$$

where k is the thermal conductivity of the fluid.

The total rate of heat transmission in the core by both mechanisms may thus be expressed as

$$Q/A = (k + \rho C_p E) dT/dy$$

In the general case, then, both heat and momentum are transferred in a parallel fashion by molecular and eddy mechanisms.

Dividing the coefficient of turbulent heat transfer  ${}_{\varphi}C_{*}E$  by the thermal conductivity k and recalling that  $E \cong UD$  and  $G = {}_{\varphi}U$ 

$$\rho C_p E/k \cong \rho C_p U D/k = G C_p D/k$$

$$= N = \frac{\text{heat transfer by convection}}{\text{heat transfer by conduction}}$$

This ratio N might be termed a "heat-transfer Reynolds number" in that it expresses the relative magnitude of convective to conductive heat-transfer forces. It is actually called the Peclet group; the familiar Stanton number can be derived from it.

If we consider a laminar layer of thickness equal to  $\Delta y$  whose thermal resistance is equivalent to the total, then this film thickness is 1/n of the diameter of the system, or

$$D = n\Delta y$$

and

$$GC_n n\Delta y/k = Peclet$$

An over-all film coefficient h defined in terms of this equivalent film would be  $k/\triangle y$ . Hence

$$Pe = GC_p n/h$$

OI

$$n/Pe = h/GC_n$$

This is the Stanton number. It varies inversely with the Reynolds number. For as the fluid velocity and turbulence increase, Pe becomes larger to a greater extent than does n, hence n/Pe decreases. The Reynolds analogy may then be stated generally

$$St = \phi (1/Re)$$

#### DERIVATION OF NUSSELT NUMBER

Another heat-transfer modulus is derived by considering the ratio of turbulent to laminar film thickness. If we characterize the turbulent film by the diameter of the system (since this is most readily known) and the equivalent laminar film thickness,  $\Delta y$ , by k/h, then the ratio becomes D/(k/h), or hD/k, which is the Nusselt number. The Nusselt number is also obtained as the product of the Peclet and Stanton numbers:

$$(GC_pD/k)(h/GC_p) = hD/k = n$$

This modulus increases in magnitude with turbulence (increasing Reynolds number) since the "film" thickness is reduced at higher flow rates. In terms of the Nusselt modulus, the Reynolds analogy becomes

$$Nu = \phi(Re)$$

The Reynolds analogy is found to be valid in only the simplest cases such as heat transfer to common gases. Referring to the heat and momentum rate equations, Reynolds' suggestion of analogy of the momentum and heat-transfer mechanisms implies numerical equality of the coefficients in each equation and, therefore, identity of the velocity and temperature profiles across the path of transfer.

Thus the Reynolds analogy applies when  $\mu/\varphi$  and  $k/C_{p\varphi}$  are negligible compared to E. This is true within the turbulent core, where the coefficients of the molecular diffusivity of heat  $k/C_{p\varphi}$ , and momentum  $\mu/\varphi$ , are negligible for most fluids, in comparison to the eddy coefficients.

#### DERIVATION OF PRANDTL NUMBER

In the laminar region, however, E approaches zero and the coefficients of viscous heat and momentum transfer are controlling. Since the laminar sub-layer constitutes more than 75 percent of the total transfer resistance within the fluid, prime attention is focused upon this region. The ratio of the viscous momentum-transfer coefficient  $\mu/\varphi$  to the conductive heat-transfer coefficient  $k/C_{\pi^2}$  equals  $\mu C_{\pi}/k$ ,

This is the Stanton number. It which is the Prandtl number. There-

$$Pr = \mu C_p/k$$
=  $\frac{molecular \ diffusivity \ of \ momentum}{molecular \ diffusivity \ of \ heat}$ 

When the principal resistance to heat transfer lies in the laminar sub-layer and when Pr approximates unity, then the temperature and velocity gradients are approximately equal. Hence, the Reynolds analogy is valid for the over-all process, since the exchange coefficient in the turbulent layer E is, by Reynolds' definition, the same for thermal and momentum transfer.

#### REYNOLDS VS. PRANDTL

Deviation of the Prandtl number from unity is a measure of the system's nonconformity to the Reynolds analogy. The Prandtl moduli for hydrocarbon oils lie between 10 and 1,000, while the value for mercury approximates 0.005. Since this modulus is a film property, its magnitude is an indication of the temperature gradient and, therefore, heat transfer, across the laminar film.

The significance of the Prandtl group is shown in Fig. 2, after Martinelli.6 Here is a plot against radial distance of the calculated ratio of the temperature difference between the wall and a point, tw-t, to the over-all difference between the wall and center line of the fluid stream, tu-tc. A typical velocity profile U/Umas is also shown, illustrating the identity of the temperature profile dT/dy with velocity profile dU/dv for the case of Pr = 1. The Prandtl number for some gases such as air approximates unity, and such systems obey the simple Revnolds relationship.

In the instance where Pr approximates 100, it is apparent that temperature and velocity profiles are far from identical, since  $U/U_{mas}$  is a function of Rc only, and that 90-95 percent of the temperature drop occurs across the thin laminar sublayer. This fluid is characterized by a high viscosity and low thermal conductivity. On the other hand, in the case of mercury ( $Pr = ca.\ 0.005$ ), only a small fraction of the temperature drop occurs across the sublayer.

The heat-transfer rate obviously varies with each extreme, hence the Reynolds analogy needs modification:

$$Nu = \phi(Re, Pr)$$

In terms of the Stanton modulus

 $St = \phi(1/Re, Pr)$ 

Since the velocity distribution dU/dy is determined by the Reynolds number, the Prandtl number, which determines the temperature distribution in the laminar film, may be viewed as a correction factor. It accounts for the lack of identity between dU/dy and dT/dy.

This modification of the Reynolds analogy is due to L. Prandtl and G. I. Taylor. These pioneer workers extended the analogy by subdividing the fluid into two regions—the laminar, where the Prandtl modulus  $\mu C_{\nu}/k$  is employed in the heat-transfer equation, and the turbulent region, treated

according to the original analogy. Within this turbulent region the coefficients of momentum and heat exchange  $E_m$  and  $E_n$  were defined as numerically equal by Reynolds. Actually the ratio  $E_m/E_n$  is less than unity. Forstall and Shapiro\* and more recently Sage and coworkers\* indicate the value to lie between 0.70 and 0.77. Sherwood\* presents an excellent discussion of the subject.

#### TURBULENT PRANDTL NUMBER

The term  $E_m/E_n$  may be considered as a Prandtl number for the turbulent core of the fluid and is termed the turbulent Prandtl group  $(Pr)_i$ . However, it is essentially different from its molecular counterpart. While  $\mu C_p/k$  is a function of the material flowing,  $E_m/n$  is independent of the fluid and the ratio has been established as a constant for common fluids. E is a function of the Reynolds number, hence the velocity and temperature gradients in the turbulent region are determined by the Reynolds number for most fluids.

The transfer of thermal energy, expressed by the Nusselt modulus, is thus properly defined by a relationship expressing the condition of fluid motion by the Reynolds group; the thermal and shear properties of the laminar sublayer by the Prandtl group; and the same properties in the turbulent region by the turbulent Prandtl number. Hence

 $Nu = \phi[(Re), (Pr)_l, (Pr)_l]$ or considering  $(Pr)_t = \text{constant}$  $Nu = \phi[(Re), (Pr)]$ 

We have then the same general equation as that developed by dimensional analysis and used by Dittus and Boelter. Colburn's equation is derived by dividing both sides of the Dittus-Boelter relation by  $(Re \times Pr)$ .

#### CHILTON-COLBURN ANALOGY

The unique advantage of the Colburn relation is that it is related to the friction factor. In general, the analogy between heat, mass and momentum transfer is expressed by the Chilton-Colburn *j* factor relation

 $\begin{array}{l} f/2 \leqq (h/GC_p) \; (P_T)^{2/3} \\ \leqq (k_e/U) \; (Sc)^{2/3} = \; \phi(Re)^{-0.2} = j \end{array}$ 

where  $k_e/U$  is the mass-transfer modulus and  $Sc = \mu/\rho D_r = Schmidt number, expressing the ratio of molecular momentum transfer <math>\mu/\rho$  to molecular diffusivity  $D_r$ .

The correlation between *j* and the friction factor *f* supports, in essence, the Reynolds analogy and its later modification to include the Prandtl group, for such cases as turbulent flow inside tubes and past plane surfaces. The virtue of such a relationship is much more than an academic one. Since data on pressure drops are much more easily obtained than heat and mass-transfer data, the above relation makes possible the prediction of heat and mass-transfer coefficients from a minimum of easily secured pressure-drop test data.

For example, Sherwood\* presents experimental data on heat, mass and momentum transfer, correlated by the Chilton-Colburn relation. Fig. 3, after Sherwood, represents such a correlation for turbulent flow in pipes. Note the data of Johnstone and Pigford for binary rectification in a wetted-wall column. Even better correlation between i and f/2 is shown by Sherwood for flat plates and single cylinders. He states that "it is at least a fair approximation to conclude that  $j_p = j_B = f/2$ ." This, of course, applies only to flat plates, turbulent motion inside tubes and perhaps single cylinders if form drag is subtracted from total friction to obtain the skin friction.

#### PROBLEMS WITH UNUSUAL FLUIDS

There are, of course, cases not so easily correlated. Heat transfer at high temperatures and the use of molten metals and eutectic salts as heat-transfer media have presented new problems. With these unusual fluids and the trend toward high-temperature and high-pressure operations, new approaches are required.

The use of molten metals as heat-transfer media is becoming more common since the advent of nuclear reactors. These fluids, typified by low Prandtl numbers, present unique temperature profiles (Fig. 2). In Fig. 4 are shown data on heat transfer to mercury. Plots of the Reynolds analogy equation and the Dittus-Boelter relation (for Pr=0.0056) are shown. Obviously even the Prandtl modification of the Reynolds relation fails to correlate the experimental data.

Examination of the basis of the Dittus-Boelter or Colburn relations reveals that these equations consider thermal conductivity only in the sublayer by the use of the Pr modulus. (Taylor and Prandtl modified the Reynolds analogy only to the extent of recognizing a laminar sublayer to which the correction C, u/k was applied.) This is justified when the film adjacent to the retaining wall constitutes the major resistance to heat transfer. The film is then an equivalent resistance. While this reasoning suffices for the commonly encountered fluids, it is inadequate for fluids in the range of low Prandtl moduli.

In the case of molten metals, the assumption that molecular conductivity k is of significance only in the sublayer is questionable. The contribution of molecular conductivity appears to manifest itself not only in the laminar but also in the transitional and turbulent regions. The Prandtl modulus can no loger be neglected in the turbulent and transitional regions. However, its exact importance in each region is difficult to ascertain.

Apparently the prediction of thermal transfer rates in such fluids is possible only with the development of useful equations which consider the transport mechanism throughout the path of convection and conduction. If the coefficients of molecular and eddy exchange can be experimentally correlated and their relative importance in each of the three regions of fluid motion ascertained, then the determination of thermal gradients can be realized. Coupled with data on the variation of the fluid properties with extreme temperatures and pressures, heat-transfer rates may be predicted.

The work of Von Karman, Martinelli and associates, and earlier that of Taylor and Prandtl is significant in this regard, for it attempts to place heat transmission upon a sound basis. Martinelli made an extensive theoretical treatment of the very practical problem of heat transfer to mercury. He employed the velocity distribution data of Nikuradse and Reichardt<sup>6</sup> to obtain dU/dy in the equation

$$\tau/\rho = (\mu/\rho + E_m) dU/dy$$

Then he solved for  $E_m$  in the turbulent core,  $(\mu/\varrho + E_m)$  in the transition region, and  $\mu/\varrho$  in the laminar sublayer. From the known value of  $E_m/E_u$ ,\* values of  $E_u$  in each region were determined.

From the heat-transfer equation

$$Q/AC_{p\rho} = (k/\rho C_p + E_H) dT/dy$$

the temperature as a function of y was determined in each layer. The various coefficients were expressed in terms of dimensionless groups; thus the Pr group was given consideration in each region of the fluid.

Martinelli obtained temperature distribution ratios as a function of Re, Pr, and distance throughout the path of transfer. (Fig. 2 is a plot of this relation.) For molten metals, he employed a ratio F = (a + b)/a, where a is the thermal resistance in the turbulent core due to eddy diffusion and b is that resistance due to molecular conductivity. Both a and b are functions of Pr.

The resulting equation for the complete range of Prandtl moduli is given above.

The denominator in this equation is proportional to the thermal resistance of the fluid flowing in the tube. Martinelli equation:

$$St = Nu/(Re)(Pr) = \frac{\frac{E_H}{5E_m} \left(\frac{f}{8}\right)^{0.5} \left(\frac{t_w - t_s}{t_w - t_m}\right)}{\frac{E_H Pr}{E_m} + \ln\left(1 + \frac{5E_H Pr}{E_m}\right) + \frac{F}{2} \ln\left[\left(\frac{f}{8}\right)^{0.5} \left(\frac{Re}{60}\right)\right]}$$

The first term is proportional to laminar sublayer resistance, the second term applying to the transition region, and the last term is proportional to resistance within the turbulent layer. The correction factor *F* reduces to unity for common fluids.

The term  $(t_w - t_e)/(t_w - t_m)$ , representing the ratio of maximum to mean temperature difference, has been evaluated for mercury, air, water and oils over a range of Reynolds numbers. A plot of these results can be found in Martinelli's original paper.

The above equation appears complicated in relation to the more simplified empirical expression. However, from the correlations obtained and shown in Fig. 5, it would seem that the equation is justified. Shown here are the curves predicted by the Martinelli equation for Pr = 0.7 and 0.0056. The data of McAdams for Pr = 0.7 and that of Styrikovich and Semenovker for mercury are also shown. The agreement achieved between the experimental data and the Martinelli relationship over such a wide range of fluids is most promising.

The conclusion drawn by Martinelli and supported by the data and his equation is that with media of low Prandtl numbers heat transfer is less a function of the Reynolds number (which determines eddy conductivity) but a greater function of thermal conductivity as expressed by Pr.

This philosophy of design, which finds its basis in the elucidation of the mechanism of fundamental processes, has received greater attention by chemical engineers in recent years. In addition to the challenges posed by new heat-transfer problems, there remains the problem of placing all chemical engineering design upon a more rigorous and fundamental basis.

Bakhmeteff has stated the essential thought underlying any progressive philosophy of science: "As the theoretical insights improve new vistas will become available to broaden the scope and refine the purpose and methods of experiment. In the close cooperation and mutual guidance between theoretical work and laboratory observations lies the key to future research. Abstract reasoning is just as sterile as blind experimenting."

#### REFERENCES

1. Bakhmeteff. B. A., "Mechanics of Turbulent Flow," Princeton Univ. Press, 1936.
2. Boelter, L. M. K., et al., "Heat Transfer Notes," Univ. of Calif. Press, 1948.
3. Colburn, A. P., Trans. AICAE, 29, 174 (1933).
4. Forstall, W., and Shapiro, A. H., Mass. Inst. Tech. Meteor Rept., 39 (July 1949).
5. Martinelli, R. C., Trans. ASME, 69, 947 (1947).
6. Reichardt, H., N.A.C.A. Technical Memo No. 1047 (Sept. 1943).
7. Sage, B. H., et al., Ind. Eng. Chem., 44 (1952).
42. 2079 (1950). T. K., Ind. Eng. Chem., 42. 2079 (1950).
5. Styrikovich, M. A., and Semenovker, I. E. Jour. of Tech. Physics (U.S.S.R.), 10, 1324 (1940).

#### Market Research (Continued from page 139)

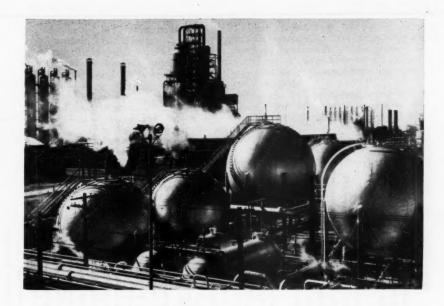
of the rubbers. There are at least a thousand different users who might find just the right use for a wheelbarrow load or a carload of this organic chemical—and it might take them a year to do it.

Clearly then, it would appear that the thing to do is to hire each of the prospective users at, say, \$10 per laboratory hour (i.e. one chemist and an assistant with supervision and facilities) to evaluate your product. This would be \$10,000 per day or \$3.5 million per year—but look at the results you might get, or you might not get. Even if you divided the number of users by 100, you would spend \$35,000 on this one product in one year just trying to find markets.

Perhaps the best thing to do is throw away this new compound and the \$10 or \$15,000 spent developing it to date. Then go back to the lab and look for a "better" one—one 10 per cent better than some similar product now on the market, and 10 per cent cheaper. Then you'll make a lot of money and have no more sales problems—all you have to do is plow in enough research money.

Now perhaps the answer is to seek a balance by undertaking limited market development work assuming the obligations that go with it. Thus you might (1) offer the compound in specified small quantities—free or at a specified price, (2) make available reliable data on its properties and on its uses already evaluated (by you), (3) follow up each real show of interest with more data and with discussions of when and under what market prospects the compound might be made available in larger quantities. In this way you are sharing with the prospective customer the applications research cost and you are making sure he is convinced of your good faith.

Recent unpublished work by T. B. Drew and S. E. Isakoff indicates that this ratio varies with Reynolds number and relative position on the cross-section for mercury.



# PETROCHEMICAL PROCESSES

Emphasizing technology rather than economics or statistics, this report brings together in one place descriptions of the major processes used to make industrial chemicals from petroleum and natural gas hydrocarbons.

GORDON KIDDOO

CHEMICAL ENGINEERING — SEPTEMBER 1952

Growing rapidly

Although there is, as yet, no universally accepted definition of the term petrochemical, almost everyone familiar with the chemical industry agrees without argument or discussion that petrochemicals constitute, by a wide margin, the fastest growing segment of the entire chemical industry.

During each of the last three five-year periods, petrochemical investment has approximately doubled. Rate of growth shows no signs of

GORDON KIDDOO is director of National Re-

search Corp.'s development department at Cam-

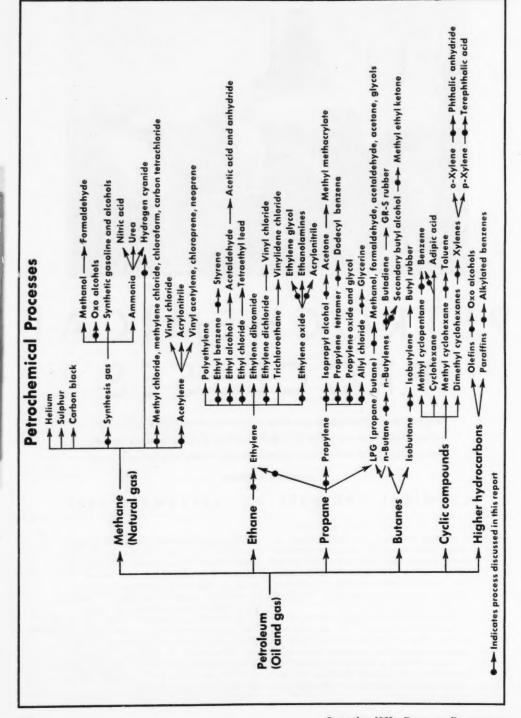
bridge, Mass. He's had years of direct experience

slackening; some observers expect it to continue to double in size every five years for at least another decade. It is estimated that capital investment in petrochemicals now exceeds \$2 billion, and that annual production is approaching 20 billion pounds of chemicals. No matter how defined, petrochemicals are big business.

Petrochemicals are generally considered to be Broad those industrially important chemicals which use definition natural gas or petroleum hydrocarbons as their basic raw materials. In general, petrochemicals are basic intermediates and are not consumed directly by the public; they are usually sold to other chemical manufacturers.

Production of petrochemicals is characterized

in petrochemicals.



not only by huge figures for total investment and output, but also by the sizes of the companies in the field and by the sizes of the physical plants required. Petrochemical processes generally require large capital investments in plant facilities; only in large-scale operations is the production of chemicals from hydrocarbons economic. Because of this factor, technology has been highly developed in efforts to reduce both capital and operating costs.

tive but stable

Inasmuch as many chemicals compete with each other, manufacture of petrochemicals is, in many respects, a highly competitive business. Because of the basic nature of the products, it is, at the same time, a stable one and not subject to wide fluctuation in production volume. This conclusion may, however, be due in large measure to the fact that it has been only during the last 15 years, when the economy of the United States as a whole has been relatively healthy, that petrochemicals have reached major stature.

During the past few years a number of specialized articles and reports on petrochemicals have been published, describing in detail the products manufactured, the companies most active in the field, and the location of and capital invested in manufacturing facilities. Descriptions of the processes used are, however, scattered throughout the chemical literature; no unified summary of the process technology of petrochemicals has been published recently.

This report, therefore, concerns principally the processes used to make petrochemicals. It generally omits references to history, companies, locations of manufacturing plants, their products and capital investment.

Limited

It's impossible to define petrochemicals in a definition manner which will satisfy everyone. However, in order to limit this report to a reasonable

length, it is necessary to draw some sort of boundary lines:

Helium, carbon black and sulphur are all Inorganics obtained commercially from natural gas and out petroleum hydrocarbons. These products are not organic chemicals, however, and the processes used for their manufacture are omitted from this report.

Ammonia-In spite of the fact that most of the ammonia and ammonia derivatives now made in the United States are derived from natural gas, the high-pressure synthesis of ammonia is not peculiar to the starting material; it was, in fact, developed in Europe and for many years practiced on synthesis gas made from coke. Even though the manufacture of synthesis gas from petroleum sources is discussed in this report, the manufacture of ammonia and its derivatives is excluded.

Benzene-Similarly, the manufacture of Derivabenzene from petroleum sources is discussed, tives out although the manufacture of benzene derivatives from petroleum-derived benzene is omitted-the technology used for manufacture of such derivatives is independent of benzene source.

Polymers-Although many polymers, plastics and resins are derived in large part from petroleum, such polymers are not considered basic petrochemicals. The manufacture of vinyl chloride, ethylene, styrene and butadiene are discussed here, but the manufacture of their polymers is omitted; the polymerization techniques were, in general, developed and first used on materials which were not derived from petroleum and the technologies are not original with petrochemical producers.

Processes discussed in the following pages are, however, believed to represent the major portion of the investment and production of petro-

chemicals.

#### Synthesis Gas and Hydrogen From Natural Gas

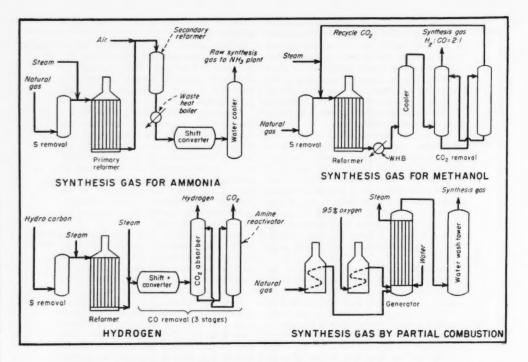
Steam-Methane Reforming for Ammonia Production-Natural gas is passed over zinc oxide at 675 to 750 deg. F. to remove all traces of sulphur compounds. The gas is then mixed with approximately 3.5 volumes of steam and passed to the reforming furnace, whose alloy steel tubes contain a supported nickel catalyst. By external firing the catalyst is maintained at approximately 1,300 to 1,500 deg. F. The natural gas and steam react to form a product gas containing principally CO2, CO and hydrogen, with lesser amounts of unconverted methane, oxygen and nitrogen. In this primary reformer approximately 93 percent of the methane is converted.

Secondary reforming

After passing from the primary reformer, the gases are mixed with a controlled quantity of air to complete the conversion and to add the nitrogen required for ammonia synthesis. This gas mixture goes into a secondary reformer at approximately 1,650 deg. F. containing another bed of supported nickel catalyst.

Gas out of the secondary reformer contains principally hydrogen and nitrogen, but there are also substantial quantities of CO and CO2. This gas is mixed with an equal volume of steam and is passed into a shift converter. Here the catalyst is pelleted iron oxide. Steam reacts with CO at 1,000 deg. F. to form CO2 and additional hydrogen, according to the water-gas reaction; the product has the theoretical 3H2:N2 ratio required for ammonia synthesis. This raw synthesis gas is cooled with water and is passed to a gas holder, which acts as a surge in the line to the ammonia synthesis unit.

Purification follows the established ammonia Purificaplant procedure, just as when the gas comes from tion coke. It is compressed in three stages to approximately 250 psi. for scrubbing with water or an ethanolamine to remove CO. It is further



compressed in two stages to 1,800 psi. and scrubbed with a solution of copper ammonium formate to remove essentially all of the remaining CO and CO2. After the copper solution treatment the gas is washed with a 5 percent caustic solution, leaving a product containing hydrogen and nitrogen in the desired ratio.

Hydrogen

Steam-Methane Reforming for Methanol Production-A synthesis gas containing essentially hydrogen and carbon monoxide in a 2:1 ratio is required. As the effluent from the primary reformer when operated for ammonia contains hydrogen and CO in a much higher ratio, the steam-methane reforming reaction is adjusted to lower the H2:CO ratio by adding heavier hydrocarbons or CO2 to the reformer feed. Nitrogen, obviously, is not required, and the secondary reformer is not used.

The CO2 in the reformer effluent is scrubbed out by water under high pressure or by an ethanolamine solution; it is recycled to the reformer feed. The 2H2:CO gas mixture is compressed to high pressure for methanol synthesis.

Hydrogen

Hydrogen by Steam-Methane Reformingsans CO The primary reformer is operated to produce a gas containing essentially hydrogen, carbon monoxide and carbon dioxide, with less than 0.1 percent of residual hydrocarbon. This gas is cooled to about 700 deg. F. with steam and is then passed in series to three iron oxide shift converters, each followed by an amine scrubber, to convert the CO to CO2 and to remove the CO2. This produces a high-purity hydrogen product stream.

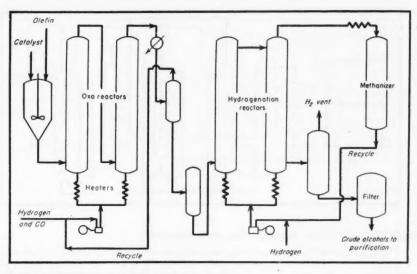
Partial Combustion of Natural Gas with Pressure Oxygen-Natural gas can be burned with lim. oxidation ited amounts of 95 percent oxygen to produce a synthesis gas containing essentially H2 and CO in a 2:1 ratio and only minor amounts of CO, methane and water vapor. This non-catalytic reaction is carried out at 2,200 to 2,600 deg. F. Its principal advantage over steam-methane reforming is that it can be carried out under pressure, obviating the necessity of compressing the increased volume of gas after manufacture.

Nitrogen can be added to this gas for ammonia manufacture. This can be done in several ways: By adding nitrogen from the air-liquefaction plant required for oxygen manufacture; by carrying out the combustion reaction with oxygen-enriched air; or by burning methane with air in a separate reactor to produce a gas containing essentially nitrogen and CO2.

The hydrogen to CO ratio obtained from the For liquid incomplete combustion of natural gas with oxy. fuels gen is almost exactly that used for methanol synthesis. It is also of immediate utility for synthetic liquid fuel manufacture.

By adding steam to this synthesis gas and passing the mixture over an iron oxide shift catalyst, the CO can be converted to CO2, which can then be scrubbed out to leave a gas containing essentially pure hydrogen, much as described above.

152



#### Aldehydes and Alcohols via the Oxo Process

The Oxo process, developed in Germany, is essentially the reaction of synthesis gas with an olefin to produce an aldehyde which can, in turn, be hydrogenated to the corresponding alcohol. The reaction can be carried out satisfactorily only with mono-olefins; diolefins and compounds containing aromatic bonds are not suitable raw materials. The olefin adds one carbon

in forming the aldehyde.

The reaction is ordinarily done in the liquid phase, in solvents such as benzene, diethyl ether or a lower hydrocarbon. Synthesis gas with a H<sub>2</sub>:CO ratio of 1:1 is used at pressures of 100 to 300 atm. and temperatures of 230 to 350 deg. F.

Catalyst

Reaction

conditions

The I.G. Farbenindustrie Fischer-Tropsch catalyst (30 percent cobalt, 2 percent thoria, 2 percent magnesia and 66 percent kieselguhr) has been commonly used, in slurry form. Although the slurry requires mixing with the feed olefin and filtration from the final product, it has proven to be more satisfactory than a fixedbed catalyst. Cobalt carbonyl, formed under the actual reaction conditions, is believed to be the active catalyst; although it is soluble in the aldehyde products, it is insoluble in the final alcohol products. Since the reaction is exothermic, internal cooling coils are provided in the

Hydrogen: carbon monoxide ratios higher than 1:1 favor hydrogenation reactions, while lower ratios favor isomerization of the olefin. Higher pressures ordinarily increase the conversion per pass. Higher reaction temperatures are preferred when the danger of double-bond isomerization does not exist, as is the case when the feed material consists of the lower olefins; high

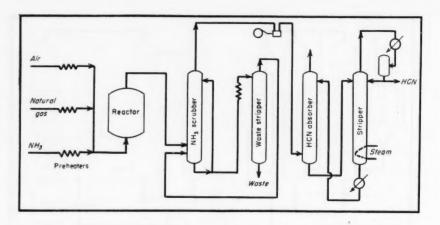
temperatures give faster reaction rates but increase the extent of double-bond isomerization when the feed consists of high-molecular weight

If a four-carbon olefin is fed to an Oxo unit, Yields 60 percent of the aldehydes are ordinarily branched-chain and 40 percent are straightchain compounds. Aldehyde yields ordinarily range from 70 to 90 percent of theoretical, based on olefin fed.

Although 40 percent of the aldehydes are To get hydrogenated in the Oxo step, it is necessary to carry out a separate hydrogenation step to complete the conversion of the aldehydes to the corresponding alcohols. The pressure on the product from the Oxo reactor is reduced, to vent the CO to the atmosphere, and the aldehydes are then recompressed to hydrogenation pressure, 150 to 300 atm.

The aldehydes are passed over a standard hydrogenation catalyst and are contacted by a stream of hydrogen. This hydrogen circulates through a methanizer to remove the CO, which otherwise would hinder hydrogenation. Upon completion of the hydrogenation the pressure on the product is released, hydrogen is vented to the atmosphere, traces of cobalt catalyst are removed by filtration, and the crude alcohol mixture is passed to conventional purification and fractionation facilities.

In U.S. practice, the Oxo reaction is used Where with selected narrow-boiling fractions of olefin used hydrocarbons. It is being used to make normal and isobutyl alcohols from propylene, nonyl alcohol from octene, iso-octyl alcohol from heptene, and 3,5,5-trimethyl hexanol from di-isobutylene.



#### Hydrogen Cyanide From Natural Gas and Ammonia

Hydrogen cyanide can be made from natural gas by the Andrussow process, in which ammonia, air and natural gas are reacted as

Reaction

In practice this reaction is carried out at conditions 1,900 to 2,000 deg. F. over a platinum catalyst. The reaction is endothermic and heat must be supplied. Some of the heat of the reaction can, of course, be supplied by burning part of the natural gas feed with air, although this is minimized insofar as is practical. Because the reaction is endothermic, the hydrogen cyanide product is stable.

The effluent from the reactor is scrubbed

with an acid solution to remove any unreacted ammonia. It is then passed to an absorber in which the HCN is absorbed in water while the unreacted methane, air, and products of combustion are allowed to pass to the atmosphere. The HCN is then stripped from the water solution and the anhydrous product is obtained as a stable liquid. As HCN boils at approximately room temperature, it must be handled and stored under refrigeration.

The yield of HCN is 75 to 80 percent of Yield theoretical, based on ammonia, the most costly of the feed materials. As it is extremely poisonous, it must be handled with extreme caution; every care is taken to ensure the safety of

operating personnel.

#### Chlorination of Methane and Ethylene

Chlorinated Methanes-Natural gas to be chlorinated is purified in a two-column oil absorption system. The first column removes ethane and heavier hydrocarbons from the natural gas; the second absorbs the methane from nitrogen contained in the gas. The methane is subsequently released from the absorption oil in a low-pressure flash tank.

Because the chlorination of methane is highly exothermic-650 Btu. per lb. of chlorine reacted-it is necessary to remove this heat of reaction in order to control the reaction temperature. This is done by carrying out the chlor-

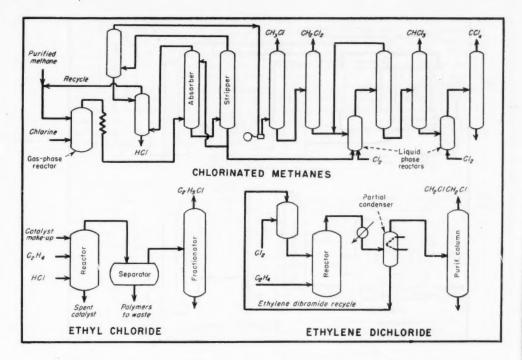
ination in several stages.

In the first stage methane is mixed with a limstage ited amount of chlorine and the gas-phase reaction is photochemically activated by a mercury arc lamp; the reaction proceeds at low pressures and temperatures. The quantity of chlorine added is controlled so that the gas can absorb the heat of reaction as sensible heat without an undue temperature rise; this prevents the reaction from running away.

The products of this stage, principally methyl chloride and methylene chloride, are absorbed in a mixture of carbon tetrachloride and chloroform. These products are subsequently stripped from the solvent.

The HCl in the overhead streams from both the absorber and stripper is absorbed in water to form a 32 percent HCl solution. The unconverted methane in the absorber overhead is recycled to the reactor. The chlorinated hydrocarbons in the stripper overhead are compressed and passed to two fractionating towers; methyl chloride is recovered from the first column and methylene chloride from the second.

The more highly chlorinated hydrocarbons Second from the bottom of the methylene chloride col- stage umn and the excess bottom stream from the stripping column are fed together to a highpressure liquid-phase reactor which also uses photochemical activation with a mercury arc lamp. The effluent from this reactor is fed to a topping column, from which methylene chlor-



ide is recovered and recycled to the reactor. The bottom stream from this column is fed to another column from which chloroform is recovered.

Third

The bottoms from the chloroform column stage are then fed to another liquid-phase photochemically activated reactor where further chlorination takes place. Carbon tetrachloride is recovered by a subsequent distillation.

Variations of this process are used for the production of perchlorethylene and chlorinated ethane and propane compounds. In some cases thermal activation at 500 to 575 deg. F. is used in gas-phase chlorination instead of photochemical activation.

In another process, chlorinated methanes are produced by using a large excess of chlorine at 800 to 900 deg. F. in the presence of a cupric chloride catalyst. The principal product of this reaction is ordinarily carbon tetrachloride, as the extent of the chlorination is not easily controlled. Operating conditions for either of these processes may, however, be regulated to change the ratio of the various chlorinated derivatives produced, although both processes always produce some of each of the four chlorinated methanes.

Ethyl chloride

Chlorinated Ethylene Products-Ethyl chloride is made principally by the addition of HCl to ethylene over an aluminum chloride catalyst. The reaction is carried out under anhydrous conditions at about 30 psig. and 100 deg.

F. The catalyst is ordinarily dissolved in a solvent, usually ethyl chloride, sometimes mixed with ethylene dichloride, and is continuously added to and withdrawn from the system.

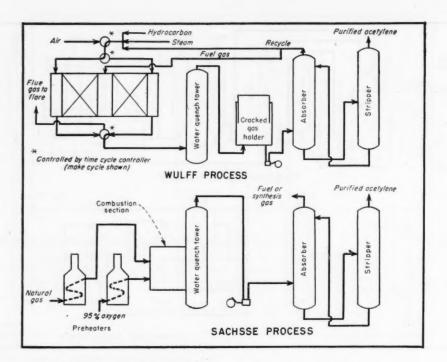
From the reactor the vaporized products are fed to a separator drum in which the ethyl chloride is separated from the heavier polymers. It is subsequently purified by fractionation. Yield of ethyl chloride is approximately 90 percent, based on ethylene fed.

Ethylene dichloride is made by the liquid- Ethylene phase reaction of ethylene and chlorine in the dichloride presence of a catalyst. Ethylene dibromide is often used as the liquid vehicle. This exothermic reaction takes place at about 110 deg. F. and only moderate pressures.

The reactor effluent is passed to a partial condenser (185 deg. F.) which liquefies the ethylene dibromide for recycle through the reactor. The reaction product, ethylene dichloride. is purified in a fractionating column. The overall yield from this process is approximately 90

Ethylene dichloride is also the major byproduct of the chlorohydrin process for ethylene glycol manufacture (see p. 161 for discussion of glycol processes).

Ethylene dichloride can be thermally cracked Vinyl at 1,100 deg. F. to split HC from the molecule chloride and yield vinyl chloride. This process is used for a considerable portion of the vinyl chloride made in the United States today.



#### Acetylene via Cracking of Hydrocarbons

Until very recently calcium carbide, made in an electric furnace, was the only commercial source of acetylene. It has long been recognized, however, that acetylene can be produced from petroleum hydrocarbons by high-temperature short-time cracking. Recently two processes for the manufacture of acetylene from petroleum hydrocarbons have been introduced commercially in the United States.

Wulff

One of these is the Wulff process. This process uses a specially designed double regenerative furnace to carry out a thermal cracking reaction while achieving good thermal efficiency. The process is cyclic, consisting of four one-minute phases.

Phases I and 2

In Phase 1 a mixture of hydrocarbon and steam is preheated in the first refractory section of the furnace, the hydrocarbon is cracked to acetylene in the center section (which is largely free of refractory), and the reaction products are cooled in the second regenerative refractory section. In Phase 2 (with flow through the furnace in the same direction) air is preheated in the first regenerative section of the furnace, is mixed with fuel gas and burned in the center section, and the hot products of combustion are cooled in the second refractory section, thereby heating the

Phases 3 and 4 of the cycle take place with

the direction of flow opposite to that in Phases Phases 1 and 2. In Phase 3 natural gas and steam are 3 and 4 heated in the first refractory section, the hydrocarbons are cracked to acetylene in the center open section, and the reaction products are quenched in the second refractory checker work. In Phase 4 air is preheated in the first refractory checker work, is mixed with fuel gas and burned in the center open section, and the products of combustion heat the second refractory checker work as they are cooled.

The center section of the furnace is main- Reaction tained at reaction temperature, 2,100 to 2,500 conditions deg. F., and the ends of the furnace are always at 200 to 300 deg. F. To keep the partial pressure of the reactant hydrocarbons at a low value, a combination of steam dilution and subatmospheric operation is used; the proper combination of these two techniques is determined by economic balance.

In a commercial plant the furnaces are always built in multiples of two so that one furnace is always on the make cycle and acetylene production is continuous.

The cracked gas is passed to a water quench Purificotower, then through a vacuum blower to a gas tion holder. From here the cracked gas, containing acetylene in a concentration of 5 to 15 percent, is compressed and passed to a purification system. In this purification system the acetylene

is absorbed by a solvent from the cracked gas and is subsequently stripped and purified. Part of the remainder of the cracked gas, containing principally hydrogen and unconverted hydrocarbons, is recycled to the cracking furnaces; the remainder is used for fuel in the heat cycle and for general plant fuel. This gas, containing CO as well as hydrogen, can be purified and also used for synthesis purposes, if desired.

Conversion per pass is dependent upon the cracking temperature. Natural gas requires the highest cracking temperature for maximum conversion to acetylene while propane, for example, can be satisfactorily cracked at lower tempera-

fures.

Recycle of cracked gas increases the ultimate vield, although it results in a lower concentration of acetylene in the reactor product. Here, again, an economic balance must be made in which the advantages of increased acetylene yield are balanced against the increased cost of recovering and purifying acetylene from a more dilute stream.

Representative yields and cracked gas compositions are:

	Methane	Ethane	Propan
Yield, % C to C₂I	I. 30-35	40-55	35-45
Cracked gas, mole	%		
C <sub>2</sub> H <sub>a</sub>	5-7.5	10-15	9-13
C <sub>2</sub> H <sub>4</sub>	3-1	25-5	20-5

The Wulff process can be used to produce appreciable quantities of ethylene, as well as acetylene, from C2 and heavier hydrocarbons. The relative amounts of ethylene and acetylene produced can be regulated by varying the cracking temperature and recycle ratio.

The other principal process used to make process acetylene from petroleum hydrocarbons is the Sachsse process, originally developed in Germany. This process involves the partial combustion of natural gas with oxygen, followed by a rapid water quench. The cracking reaction takes place at approximately 2,700 deg. F. at atmospheric pressure; reaction time is less than

Yield of acetylene, based on natural gas, is Yields 30 to 35 percent, and the product gas has the following composition:

Component	Mole Percent
C <sub>2</sub> H <sub>2</sub>	8-9
$CO_2$	3-4
CH.	6-7
CO	24-26
H,	56

This process has the advantage of producing Pres a cracked gas with a higher acetylene content and with valuable quantities of H<sub>2</sub> and CO which can be used for synthesis gas purposes. Its utility is limited to operations with natural gas feed, however, and it also has the disadvantage of requiring the use of 95 percent oxygen.

Both processes produce significant quantities of higher acetylenes, such as methyl acetylene, vinyl acetylene and diacetylene. These compounds must be removed from the acetylene product because they are explosive and because they interfere with chemical uses for which the

acetylene may be destined.

For the purification of the cracked gases, Complex solvent recovery systems actually used are more complex than shown in the above flow sheets. Among the selective solvents which have been used are acetone, trimethyl urea, dimethyl formamide, and acetonyl acetone. By the use of such solvents in complex systems, it is possible to produce acetylene which is as pure as that made from calcium carbide.

#### Ethylene and Propylene via Thermal Cracking

Although ethylene and propylene were once recovered principally from refinery gas streams, the availability of such streams is limited. Ethylene and propylene are now ordinarily made by thermal cracking of light hydrocarbons. Ethane, propane or mixtures of these hydrocarbons are the most commonly used materials for ethylene manufacture; propane or heavier hydrocarbon feeds are required for propylene manufacture.

Reaction

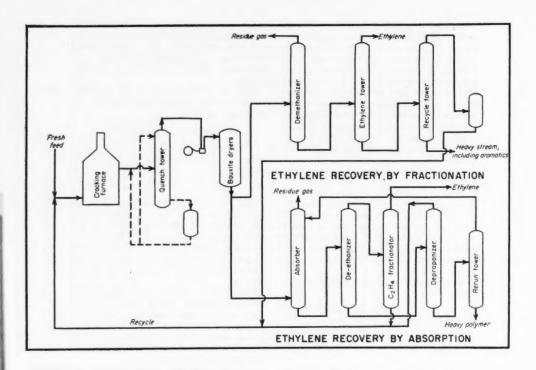
These hydrocarbons are cracked in directconditions fired furnaces provided with 25-20 (chromenickel) alloy tubes. The furnace is so fired that there is an increasing temperature gradient from the feed inlet to the furnace outlet. The cracking reactions take place at 1,350 to 1,500 deg. F. with a residence of 0.7 to 1.3 sec., computed on the basis of the coil outlet temperature. Operation at a somewhat higher temperature is required when cracking ethane than when cracking propane.

Conversion per pass and ultimate yield de- Yields pend principally upon the raw materials used and the time-temperature relationship in the furnace. Increasing the coil outlet temperature ordinarily increases the conversion per pass, at the same time decreasing the yield somewhat in the temperature range in which the cracking is ordinarily carried out.

Hydrocarbons heavier than the desired olefin are recycled from the recovery section back to the cracking furnace. Thus, if ethylene is the only desired product, it is necessary to recycle to the cracking furnace the propylene formed by cracking the propane feed.

If propylene, as well as ethylene, is desired for chemical purposes, it can be separated and purified. In practice propane and recycle propylene are often cracked in a separate furnace from the ethane fraction to achieve optimum

time-temperature conditions.



Olefin

It is more difficult to crack propylene or other cracking olefins than propane, principally because they tend to polymerize or degrade to coke. When cracking a mixture of 25 percent ethane and 75 percent propane, it is reasonable to expect a Ca conversion per pass of 85 to 90 percent. When cracking a mixture of 25 percent propane and 75 percent propylene, however, the conversion per pass is estimated at 75 percent for the propane content and 50 percent for the propylene content of the feed.

Typical commercial cracking results on singlepass ethane and propane cracking have been

Cracking stock	Ethane	Ethane	Propan
Coil outlet temp.,			
deg. F.	1,425	1,475	1,435
Pressure, psig.	30	15.6	15
Reaction time, sec.	1.05	1.5	
Conversion, percent	38.5	71.1	
Product distribution	1,		
mole %			
H <sub>2</sub>	26.0	40.8	9.4
CH,	2.5	2.9	21.9
C <sub>2</sub> H <sub>4</sub>	25.5	36.5	19.7
C <sub>2</sub> H <sub>6</sub>	45.2	17.2	0.5
C <sub>8</sub> H <sub>6</sub>	0.2	0.6	24.5
C <sub>s</sub> H <sub>s</sub>		0.3	0.6
C,	0.3	0.5	1.7

0.1

0.7

10.5

These data show the effect of coil outlet temperature and reaction residence time on percent conversion and product gas composition. They also show the differences in the gas composition when cracking ethane and propane.

The reactions taking place are essentially dehydrogenation and pyrolysis. This is why the hydrogen content of the product obtained by ethane cracking is much richer in hydrogen and has a higher ethylene concentration than does the product from propane. It also explains why the methane content of the propane cracking product is higher than that from ethane cracking and why considerable quantities of propylene are produced.

Pyrolysis of ethane and propane is ordinarily Low carried out at pressures below 30 psi.; at higher pressures pressures polymerization and condensation reactions of the products occur. Generally, the pressures used for cracking unsaturated feeds or high-molecular weight feeds are lower than those for cracking straight ethane, for example.

The reactions are entirely non-catalytic, although it has been advisable to supply a small quantity of steam to the cracking furnace along with fresh feed. This has the effect of minimizing coke formation and preventing corrosion from sulphur compounds in the hydrocarbons being cracked.

Published estimates of ultimate vields of ethylene from various feed materials are:

Feed	Wt.	percent	ultimate	vield
Ethane			75	
Propane			. 48	
Gas oil			25-32	

Recovery

The three most widely used schemes for the recovery and purification of ethylene from cracked gases are: (1) Low-temperature fractionation; (2) fractionating oil absorption; (3) adsorption on charcoal by the Hypersorption

Fractionation

In recovering ethylene by low-temperature fractionation, the effluent from the cracking furnace is quenched with water and then cooled to 100 deg. F. in a water quench tower. The product is then compressed in three or four stages to 600 psi., cooled to 65 deg. F., and dried over bauxite to a dewpoint of -100 deg. F. The gas is then fed to the low-temperature fractionation system. This consists of a demethanization column operating with a top temperature of -130 deg. F., an ethylene tower producing purified ethylene as the overhead product, and a recycle tower producing an overhead stream for recycle to the cracking unit and a bottom stream of polymers and heavy materials, including aromatics.

For propylene recovery an additional tower is required between the ethylene tower and the recycle tower. This tower produces a purified propylene overhead; the bottoms stream is the feed for the recycle preparation tower.

The low-temperature fractionation recovery system does, of course, require the use of external cascade-type refrigeration.

In recovering ethylene by absorption, the Absorption effluent from the cracking furnace is quenched. compressed, and dried. It is then passed into an absorption tower in which the ethylene and the heavier materials are absorbed, the methane

passing to the flare.

The absorption oil is then fed in series to a de-ethanizer, a depropanizer and a rerun tower in which polymer is the bottom product and lean oil is the overhead product. The overhead from the de-ethanizer is sent to the ethylene fractionator, which produces ethylene as the overhead stream and recycle for the cracking furnace as the bottom product. The overhead from the depropanizer column contains heavier hydrocarbons and is also recycled to the cracking furnace.

In the Hypersorption process light hydro- Adsorption carbons are adsorbed on a moving bed of activated charcoal and are then selectively desorbed. A C<sub>2</sub> cut is obtained, which is fractionated into an ethylene product stream and an ethane stream for recycle to the cracking unit. This process is particularly useful and economical with gas streams whose ethylene content is low.

#### Polymerization and Alkylation Processes

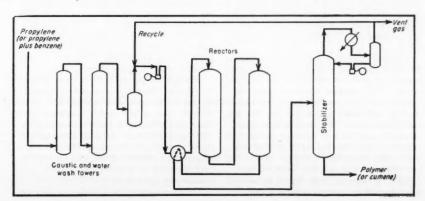
Versatile

Propylene tetramer, C12H36, a straight-chain process polymer of propylene, is produced by a process originally developed for the polymerization of refinery propylene and butylenes. Many refiners are, in fact, able to switch without difficulty from the manufacture of polymer gasoline to tetramer production. More recycle is employed in producing tetramer-to increase the molecular weight of the polymer-than is used when producing polymer gasoline, which has a somewhat lower average molecular weight.

Polymerization of propylene is carried out

at 300 to 400 deg. F. and at a pressure of approximately 500 psi.; the optimum operating conditions are usually decided by economic considerations. The most commonly used catalyst is phosphoric acid, either liquid acid deposited on 28 to 35-mesh quartz chips or 4-in. × 4-in. cylindrical pellets of kieselguhr and phosphoric acid. The yield of tetramer, or dodecane, is 80 to 85 percent of the propylene fed to the unit.

Dodecane is desired for alkylation with ben- Dodecyl zene to form dodecyl benzene, which is exten- benzene sively used for alkyl aryl sulfonate detergents.



Keryl benzene, also used for these detergents, is similarly made by alkylating benzene and a selected kerosene fraction.

Isopropyl Benzene-A plant for tetramer production can also be switched to isopropyl benzene (cumene) production without appreciable alteration. Capacity for isopropyl benzene is roughly the same for the same total propylene reacted in tetramer manufacture. In any of these applications of this catalyst, a C<sub>8</sub> fraction containing 30 percent or more propylene is satisfactory.

Goes to

Isopropyl benzene is in considerable demand phenol at the present time because it is used as a starting material in the newly developed synthesis of phenol and acetone. During the war it was used for a while in aviation gasoline.

Ethyl Benzene-A plant basically similar to those for tetramer and isopropyl benzene production can be used for the production of ethyl benzene. Operating conditions are sufficiently different, however, so that interchangeability of operations is not feasible. Benzene and ethylene are usually reacted at essentially atmospheric pressure and at 200 deg. F. with an aluminum chloride catalyst. Ethyl benzene of greater than 99 percent purity is separated from unreacted benzene and polyethybenzene, scrubbed with sodium hydroxide, and dried by percolation through a bed of caustic.

Styrene-Ethyl benzene can be catalytically dehydrogenated to styrene at a conversion of 35 to 40 percent per pass over a selected dehydrogenation catalyst, such as iron oxide supported on alumina. By regulating the vapor feed temperatures, the temperature of the reactor is held at 1,150 to 1,200 deg. F. Steam is fed to the reactor at the rate of 2.6 lb. per lb. of ethyl benzene fed.

The effluent from the reactor is cooled by heat exchange and direct water spray. Vent gases, including hydrogen, carbon monoxide, carbon dioxide, methane, ethane and some aromatics are taken to a refrigerated recovery system. The condensed materials are separated by gravity decantation of the hydrocarbons from the water phase. Insoluble hydrocarbon tars are then settled from the crude styrene. Benzene and toluene are distilled overhead under vacuum, leaving a bottom column stream containing essentially styrene, along with ethyl benzene and tar.

Elemental sulphur is dissolved in styrene to Sulphur act as a polymerization inhibitor during the final two-stage distillation. In the first stage ethyl benzene is distilled overhead and in the second stage styrene is separated from the tar. This final distillation is done at 35 mm. Hg abs. and a bottom temperature of less than 200 deg. F. Vacuum distillation and low temperature are required to prevent polymerization of styrene.

Yield of styrene based on ethyl benzene is Yields about 90 percent; this gives an over-all yield of 86.5 percent for styrene from benzene and ethylene.

#### Alcohols From Olefins

Ethyl Alcohol-Two processes are used commercially for the manufacture of ethyl alcohol from ethylene. The older and more widely used process involves the absorption of ethylene in concentrated sulphuric acid with subsequent hydrolysis.

Absorption

The absorption is carried out at 160 to 180 conditions deg. F. and at 200 to 500 psi., depending upon the concentration of ethylene in the feed. The bottom stream from the absorber, containing mono- and diethyl sulphate, is passed to the hydrolyzer. Here it is contacted with water to vield alcohol, dilute sulphuric acid and ethyl ether.

The entire stream is passed to an acid stripper from which the alcohol, ether, and a small amount of acid are removed as the overhead stream. This overhead stream is passed to a column where the residual acid is removed by washing with dilute caustic solution; the overhead stream from the caustic wash column is condensed and the vent gases are washed with water to recover the last traces of alcohol and ether. The condensate and wash solution are combined and sent to crude alcohol storage.

Ether is removed from the crude alcoholether mixture as overhead from a fractionator.

The bottom stream from the ether fractionator is sent to the alcohol fractionator. The top product here is 95 percent ethyl alcohol and the bottom product is essentially water.

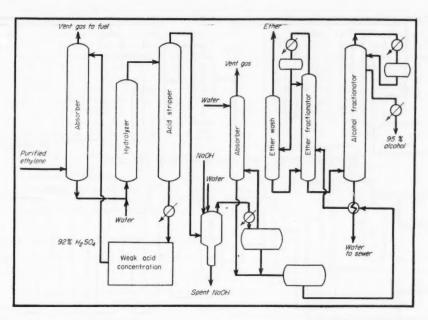
The ultimate yield of alcohol is over 90 per- Yields cent, on the basis of ethylene, and the ethyl ether by-product amounts to about 5 percent

of the alcohol production.

The principal problem in this process is the Acid utilization of the bottom stream from the stripper, a 50 percent sulphuric acid solution. This acid can be concentrated to 70 percent by distillation at atmospheric pressure; the concentration is then raised to 92 percent by twostage vacuum evaporation. This acid is then returned to the ethylene absorption column.

Although 98 percent acid is more suitable for ethylene absorption, as it permits operation at lower pressures and temperatures, this strength acid is not readily produced from dilute acid. Thus a plant which can use the dilute acid elsewhere can avoid the expensive reconcentration of the dilute acid from the stripper by purchasing strong acid for ethylene absorption and by disposing of the dilute acid solutions to these other operations.

The other process for alcohol from ethylene



Direct is used in only one commercial plant in the hydration United States. Ethylene is hydrated directly to ethyl alcohol over a solid phosphoric acid catalyst. The reaction is believed to take place at 600 to 1,000 psi. and at 400 to 600 deg. F. The conversion per pass is low, but the ultimate yield is over 90 percent because considerable recycle is used. Because this large recycle stream is necessary, however, the ethylene feed must be quite pure or inerts will build up.

Isopropyl alcohol is made by a process similar to that used for the manufacture of ethanol. Propylene-rich gases are absorbed in an 85 percent sulphuric acid solution at approximately 80 deg. F. The reaction is very exothermic and requires cooling of the absorption column. Under these conditions, ethylene is not absorbed, but more than 50 percent of the propylene is absorbed; by recycling the vent gases a higher vield of isopropanol can be obtained.

The bottom stream from the absorption column is diluted with water and steam to a 20 percent concentration in a lead-lined tank. The heat of dilution supplies sufficient heat for vaporization of the alcohol from the hydrolyzing solution. The diluted acid is reconcentrated to 85 percent and is returned to the absorption tower.

The alcohol solution from the dilution vessel is distilled to yield 91 percent isopropanol-water azeotrope. This azeotrope is washed with mineral oil to remove selectively higher alcohols, such as secondary butyl alcohol. Anhydrous isopropyl alcohol can be obtained by distilling the 91 percent alcohol with di-isopropyl ether.

The over-all yield of isopropyl alcohol is about Yield 75 percent, on the basis of propylene fed to the

Secondary butyl alcohol is formed by a process similar to that used to make ethanol and isopropanol. It involves the absorption of butylene in sulphuric acid with subsequent hydrolysis to yield secondary butyl alcohol.

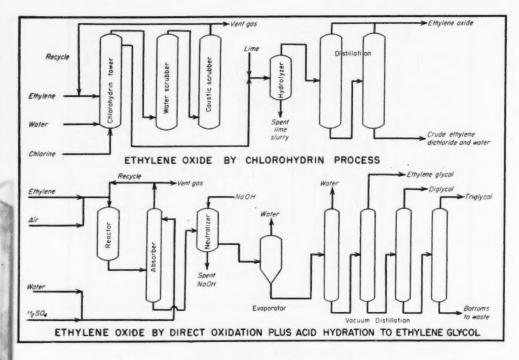
The manufacture of isopropyl and secondary Fasy butyl alcohols is considerably easier to carry out to do than is the ethylene absorption and hydrolysis reaction. This is because propylene and butylene are easier to absorb in sulphuric acid. No direct hydration processes are used for the manufacture of isopropyl or secondary butyl.

#### Ethylene and Propylene Oxide and Glycols

process

The older and more widely used process for hydrin ethylene oxide is the chlorohydrin process. Chlorine and water are combined to form hypochlorous acid. Ethylene is bubbled through the hypochlorous acid solution to form ethylene chlorohydrin. This reaction is slightly exothermic and is carried out at 100 to 125 deg. F., at high pressure, and with an excess of ethylene present.

The dilute ethylene chlorohydrin product is continuously removed to keep the concentration in the chlorohydrin tower low and thus minimize formation of ethylene dichloride. As some free chlorine is always present in the hy-



pochlorous acid solution, however, appreciable quantities of ethylene dichloride are unavoidably formed. The overhead stream from the chlorohydrin tower is washed first with water and then with caustic to remove chlorine and HCl; most of this stream is recycled and a part is vented.

The combined ethylene feed usually has an ethylene concentration of 70 to 75 percent; lower concentrations can be used but are usually not economic. Over-all chlorohydrin yields are

75 to 80 percent of theory.

The dilute chlorohydrin solution is hydrolyzed with a 10 percent lime solution and direct steam at 200 to 215 deg. F. under vacuum. The overhead product from the hydrolyzer is principally water, ethylene oxide and ethylene dichloride. The products are separated and purified by more or less conventional fractional distillation.

The yield of ethylene oxide from ethylene **Vield** of oxide chlorohydrin is 90 to 95 percent; over-all yield from ethylene is approximately 70 percent.

In one modification of this process the necessary hypochlorous acid is formed by reacting chlorine with hydrated lime, with calcium chloride as a co-product. Calcium chloride is carried through to the hydrolyzer where it is removed with the spent lime slurry.

Hydrolysis

The newer process for making ethylene oxide oxidation is the direct oxidation process, based upon the work of Lefort. Ethylene is oxidized with air directly to ethylene oxide over a supported silver catalyst. The reaction is carried out at atmospheric pressure, at a temperature of 520 to 550 deg. F., and with a considerable excess of air. Conversion per pass is 30 to 40 percent, and with recycle of unconverted ethylene, yields of ethylene oxide, based on ethylene, of 50 to 60 percent are realized.

As this is a highly exothermic reaction, tem- Control perature control is a major problem. This is problem solved industrially by placing the catalyst in narrow vertical tubes around which oil is circulated to remove the heat of reaction. As each reactor may contain several thousand such tubes, the problem of evenly distributing the feed to all tubes is considerable.

The effluent from the oxidation reactors is passed to an absorber in which ethylene oxide is absorbed by water. It is then stripped from the water under vacuum. The purified product is removed from the last traces of water by frac-

Capital investment in a direct oxidation plant Pros is less than that for a chlorohydrin plant, the and cons use of chlorine is avoided, and no ethylene dichloride is produced. This process has the disadvantage, however, of giving somewhat lower yields of ethylene oxide.

Although ethylene chlorohydrin can be hydrolyzed directly to ethylene glycol by the use of caustic soda, a better yield of glycol is obtained when two-stage hydrolysis via ethylene oxide is used. Furthermore, it is thus possible to

use cheap lime in the place of caustic in the first step of the two-step hydrolysis.

To Commercially, ethylene oxide is converted to glycol ethylene glycol by hydration, catalyzed by small concentrations of strong acid, or by hydration at 380 deg. F. and 200 psi. The first method is preferred when simultaneous absorption of ethylene oxide from a gas and hydrolysis to glycol is desired, as is often the case in the direct oxidation process.

The acid concentration is maintained at less than 1 percent to minimize formation of polyglycols. A 10 to 20 percent glycol solution is continuously withdrawn, neutralized with NaOH, concentrated to 90 percent by evaporation, and then fractionated under vacuum to give specification products. A somewhat similar process is used for purification of the glycol formed by high-pressure hydration.

The other major outlet for ethylene oxide is To ocryloacrylonitrile. By reacting ethylene oxide with nitrile HCN over alkaline earth catalysts, ethylene cyanohydrin is produced in good yield. This is then dehydrated over a catalyst such as activated alumina to give acrylonitrile in yields of 90 percent. This process, however, is meeting increased competition from the direct synthesis of acrylonitrile from acetylene and HCN.

Propylene oxide and glycol are made by a process similar to the chlorohydrin process for ethylene oxide and glycol. Ordinarily ethylene and propylene oxide and glycols are made separately, although at least one U.S. producer is known to feed an ethylene-propylene mixture to the chlorohydrin tower and to separate the ethylene and propylene glycols by vacuum fractionation. Propylene oxide is not manufactured by direct oxidation process.

#### Ketones via Dehydrogenation of Alcohols

Ketones are produced by the dehydrogenation conditions of alcohols. Alcohol vapor is passed over a copper or zinc-copper alloy catalyst; the reaction takes place at approximately 925 to 950 deg. F. at pressures up to 50 psig. Internal cooling of the reactor is necessary.

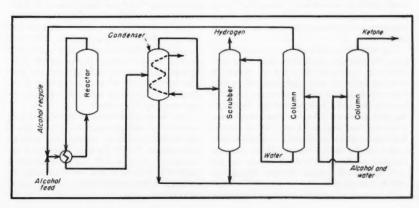
The hot effluent gases from the reactor are used to preheat the feed stream and are then passed to a water-cooled condenser. The noncondensable overhead is scrubbed with water to remove the last traces of entrained alcohol and ketone, and the water-alcohol-ketone mixture is added to the bottom stream from the condenser. These streams are fed to a fractionating column where the ketone product is taken overhead and an alcohol-water mixture is the bottom product.

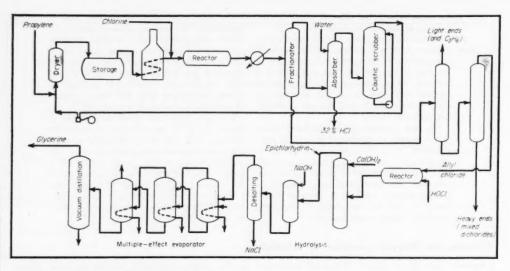
The alcohol-water product is then fractionated, the alcohol passing overhead and being recycled to the reactor. The water, the bottom stream, is used to scrub the noncondensable gases from the product condenser. Hydrogen comes overhead from the scrubber.

This process is commonly used for the manu- Acetone facture of acetone from isopropyl alcohol, with yields of approximately 85 to 90 percent of theoretical. Some plants producing acetone from isopropyl alcohol employ an oxidationdehydrogenation process; in such plants air is added to the alcohol vapor and the hydrogen from the alcohol molecule is oxidized to water.

In this version of the process the catalyst is either a silver or copper compound and the overhead from the scrubber is essentially nitrogen, rather than hydrogen. The production of acetone is ordinarily carried out at 40 to 50 psig. to make the recovery of the ketone in the condenser and scrubber somewhat easier and to reduce water requirements of the scrubber.

The straight dehydrogenation process is com- MEK monly used for the production of methyl ethyl ketone from secondary butyl alcohol. This reaction is ordinarily carried out at approximately atmospheric pressure, as the recovery of MEK is somewhat easier than that of acetone. Yields of MEK are 80 to 90 percent of theoretical.





#### Synthetic Glycerine from Propylene

Although glycerine is still produced principally as a by-product of soap manufacture, a steadily increasing fraction of the U.S. production is synthetic.

Operating details of the synthetic glycerine process in commercial use have not been published. Sufficient information is available, however, to put together a process description which is believed to be reasonably accurate.

The first step involves the manufacture of allyl chloride. Key to this synthesis was the discovery that reaction of propylene and chlorine at high temperatures results in the substitution of chlorine on the methyl group adjacent to the double bond and does not result in addition of

Commercially, this reaction is carried out by rapidly and thoroughly mixing chlorine and propylene, preheated to 750 deg. F., to avoid addition or uncontrolled chlorination. The molar ratio of propylene to chlorine is 5, the pressure is approximately 15 psig., and the residence time in the reactor is on the order of only 2 sec.

The reaction products are cooled and fractionated. The overhead stream from the fractionator, containing principally HCl and propylene, is scrubbed first with water and then with caustic to remove HCl from the propylene recycle. The bottoms are passed to a two-column fractionating unit in which light ends (including some propylene) are removed from the top of the first column and the allyl chloride is taken overhead from the second column. Heavy ends are contained in the bottom streams from the second column. The yield of allyl chloride is Chlorehy- greater than 85 percent.

The second step is the chlorohydrination of

allyl chloride followed by subsequent hydrolysis of the resulting dichlorohydrins. The desired chlorohydrination step takes place in the aqueous phase. Inasmuch as allyl chloride is not very soluble in water, the quantity of water-insoluble material in the reaction zone is kept low to avoid the formation of undesirable chloroethers and chlorine addition compounds. The reaction is carried out at approximately 85 deg. F. In this step glycerol dichlorohydrin yield is more than 90 percent.

The dichlorohydrin is next hydrolyzed to Hydrolysis glycerine. Lime cannot be used for the complete hydrolysis, however, as slycerine is not readily distilled from calcium chloride. Sodium hydroxide can be used for the complete hydrolysis; in commercial practice, however, for reasons of economy, this is not done. Instead, glycerol dichlorohydrin is partially hydrolyzed with lime in a stripping column giving high yields of epichlorohydrin (used for manufacture of Epon resins), which distills overhead.

The epichlorohydrin is then hydrolyzed with Two steps sodium hydroxide to give glycerine. The NaCl vs. one resulting from this reaction is removed. By thus carrying out the hydrolysis in two steps it is possible to substitute one mole of relatively cheap lime for two moles of sodium hydroxide. Overall yields of glycerine from allyl chloride are approximately 90 percent.

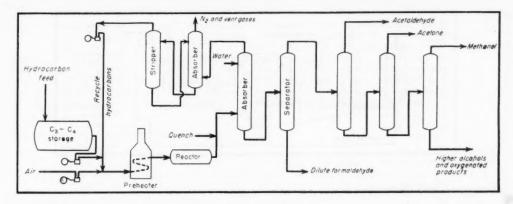
The crude glycerine-water mixture is concentrated in multiple-effect evaporators and is then further purified by vacuum distillation for final removal of salt. To meet commercial specifications for glycerine it may be necessary to purify the glycerine further by decolorizing, by extraction with a solvent such as xylene, and by redistillation.

drination

chloride

September 1952—CHEMICAL ENGINEERING

164



#### Aldehydes and Alcohols by Hydrocarbon Oxidation

Direct oxidation of saturated hydrocarbons to oxygenated chemicals has been the subject of research efforts for more than 40 years and has been practiced commercially in the United States for 25 years. It is only within the past 10 years, however, that direct oxidation has become of major importance.

In the largest oxidation plant in the United and States a mixture of propane and butanes is oxibutanes dized with air. Although catalysts are mentioned in the literature, the process in commercial use is a non-catalytic vapor-phase reaction ordinarily carried out at 600 to 1,000 deg. F. and pressures of 100 to 300 psi.

> The hydrocarbon feed mixture and air are compressed, mixed with recycle hydrocarbons, and preheated to 500 to 600 deg. F. This temperature is high enough to initiate the reaction; the heat of reaction further heats the gas mixture to 800 to 1,000 deg. F. at the reactor outlet.

> The reactor effluent is quenched and passed to an absorber in which the reaction products are absorbed by water. The overhead stream from the absorber contains principally unreacted hydrocarbon and nitrogen (from air). This stream is passed to a conventional oil absorption and stripping system where the nitrogen is removed from the hydrocarbons and is vented. The hydrocarbons are compressed by a booster compressor and recycled to the reactor.

> The bottom stream from the absorber contains the oxygenated products. This stream goes to a separation and purification system far more complex than the simple one shown on the accompanying flow sheet. Absorption, distillation, extraction, extractive and azeotropic distillation are used to produce specification chemicals. The ultimate vield of saleable chemicals is estimated to be 50 percent, on the basis of fresh hydrocarbon feed.

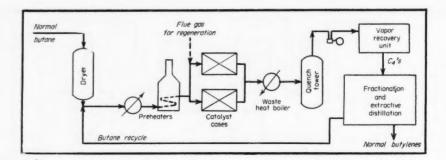
A similar process has been used for many Natural gas years to produce principally methanol, formaldehyde and acetaldehyde, with lesser amounts of higher oxygenated compounds, by the direct oxidation of natural gas.

It is necessary to limit the oxygen content of the reactor feed to prevent the exothermic reaction from running away. Although the conversion per pass is thus limited, the ultimate yield is increased by recycle of the unconverted hydrocarbons. High yields, and thus use of recycle, is more important and necessary when using a relatively costly hydrocarbon feed, like propane, than when a cheaper feed, such as natural gas, is used.

Oxygen can be used instead of air in this Oxygen process and the choice is an economic one, vs. air principally. If oxygen is used the hydrocarbon partial pressure is greater, at any given total pressure, and the yield is thereby increased. Furthermore, if hydrocarbon recycle is used, use of oxygen instead of air eliminates the necessity for removing nitrogen from the recycle gas

Increasing the reaction pressure increases the Optimum yield of product, because the hydrocarbon partial pressure is thereby increased, but the increase in yield is not great. In practice the oxidation pressure is set high enough to facilitate the absorption and recovery of the oxygenated products; the precise operating pressure is selected by balancing the cost of compression against the higher vield and capital savings on the recovery and purification unit which can be realized at increased pressures.

One plant, although never successfully operated, was designed to oxidize natural gas with oxygen at pipeline pressure (600 to 800 psi.) on a once-through basis, i.e., no recycle. It was thought that operation at this pressure would facilitate product recovery. By using oxygen and operating without recycle it was believed that a tail gas would be produced with a sufficiently high heating value to warrant boosting the pressure and returning the gas to the pipeline downstream of the chemical plant.



#### Butylenes and Butadiene

Normal butylenes are used principally for butadiene manufacture and to a lesser degree for the manufacture of polybutenes, viscous polymers used principally for caulking and sealing compounds. They are found in many refinery gas streams, particularly those produced by catalytic cracking processes, and are also produced by the catalytic dehydrogenation of normal butane.

Reaction

This process, developed principally by Phillips conditions Petroleum Co., utilizes chromia-alumina catalyst in the form of \{\frac{1}{2}\cdot\). \times \{\frac{1}{2}\cdot\}. \times \(\frac{1}{2}\cdot\). cylindrical pellets and requires a charge of 98 percent normal butane dried over bauxite. The reaction takes place at approximately 1,100 deg. F., at pressures just slightly in excess of atmospheric, and at a space velocity of 850. At these conditions the conversion is 30 to 40 mole percent and the ultimate yield 70 to 90 percent.

> The catalyst requires periodic regeneration by treating with a mixture of hot flue gases and steam whose oxygen content is 2 to 3 percent. The length of the dehydrogenation cycle is usually one hour and the regeneration cycle is of the same length. The reactors are built in duplicate, however, so that production of butylenes does not stop during regeneration of the catalyst.

> The effluent from the reaction vessel is quenched to 140 deg. F. in four stages and is then compressed to 200 psi. in three stages; the condensate thus produced is fed to the fractionation and extractive distillation section. The uncondensed portion of the stream is passed to a conventional oil absorption and stripping unit for recovery of the C's and removal of other light gases from the system.

Separation

The combined C, fractions are subjected to methods fractionation and extractive distillation, usually with furfural, to remove normal and isobutanes, isobutylene, pentane and other impurities; butene-1 and butene-2 are thus available as raw material feed for the butylene dehydrogenation section of the butadiene plant. Essentially the same extractive distillation processing is also used on refinery and catalytic cracking gas streams

which contain butylenes to prepare feed for the butylene dehydrogenation step.

Butadiene is produced from normal butylenes Butylenes by catalytic dehydrogenation. Butene-1 and butene-2 are dehydrogenated over a catalyst containing magnesium, iron, copper and potassium oxides in the presence of steam, with a steam: butylenes ratio of 15 or 20:1. Steam dilution is necessary to maintain low hydrocarbon partial pressure, approximately 100 mm., and thereby minimize the tendency for butadiene to polymerize and ultimately to degrade to coke and

The reaction temperature of 1,150 to 1,250 deg. F. is attained by preheating the butylenes separately in heat exchangers to about 1,100 deg. and mixing them with steam superheated to approximately 1,300 deg. F. The residence time in the reactor is approximately 0.2 sec. with a 50 to 75-deg. F. temperature drop occurring through the catalyst bed. The reaction is highly endothermic, necessitating adding 725 Btu. per lb. of butylenes converted by means of the superheated steam.

As the activity of the catalyst drops off slightly Cyclic with use, the operation is cyclic. Regeneration operation of the catalyst is accomplished by merely shutting off the butylene feed and allowing the superheated steam to remove carbon from the catalyst by the water gas reaction.

The effluent gases from the reaction vessels

are quenched to 950 deg. F. by means of a condensate stream and are then further cooled in a waste-heat boiler and in a series of quench towers. The condensate from the water separator contains the bulk of the C, hydrocarbons. It is charged into a fractionating column, where it is stabilized by removal of a light overhead stream. The stabilized condensate from this column is fed to a rerun tower where polymer materials are removed from the bottom and crude butadiene and other C, hydrocarbons are condensed as the overhead product. This over-

head product is combined with C, hydrocarbons

recovered from an oil absorption system operat-

ing on the noncondensable gases from the

quench tower water separator; the combined feed is charged to the butadiene purification

Extractive distillation

The C4 fraction containing crude butadiene is purified by extractive distillation with a copper ammonium acetate solvent or with furfural. A product containing 98 to 99 percent butadiene is obtained from this purification step.

Isobutylene can be manufactured by the catalytic dehydrogenation of isobutane by a process similar to that used for the catalytic dehydrogenation of normal butane. It is also recovered in large volumes from refinery catalytic cracking gas streams. Isobutylene is required for the manufacture of alkylate for aviation fuels and for making butyl rubber.

#### Aromatics via Catalytic Reforming

Prior to World War II all aromatics for chemical use were by-products of the coking of coal. Now, however, considerable quantities of benzene, toluene and xylene are made from petroleum hydrocarbons, and processes for their manufacture are growing in commercial impor-

Reactions

Aromatics are produced from naturally occurring petroleum hydrocarbons by these reactions: (1) Dehydrogenation of six-membered ring naphthenes to aromatics; (2) dehydro-isomerization of alkyl cyclopentanes to aromatics; (3) cyclization of paraffins to naphthenes and subsequent dehydrogenation to aromatics.

Thus, benzene, for example, can be considered to be manufactured by the dehydrogenation of cyclohexane or the dehydro-isomerization of methyl cyclopentane. In addition, some hydrocracking of high-molecular weight paraffins to lower-molecular weight paraffins, isomerization of straight-chain or slightly branched paraffins to highly branched paraffins, and desulphurization of sulphur compounds also occur in the commercial processes for the manufacture of aromatics from petroleum hydrocarbons.

Three

The processes used for the production of aromatics all involve three steps: (1) Feed preparation; (2) catalytic reforming (by the reactions listed above), and (3) product recovery and puri-

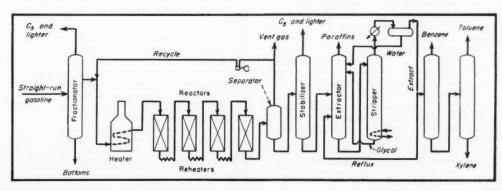
The feed preparation unit consists essentially of super-fractionation equipment in which selected naphtha cuts of the proper boiling range and containing the desired raw material hydrocarbons can be prepared.

The reforming processes can be divided into two groups, those utilizing catalysts requiring regular and periodic regeneration, and those utilizing catalysts which require no regeneration.

The first commercially important reforming process for aromatics production was Hydroforming. This process was used extensively in World War II for the production of toluene. It utilizes a molybdena catalyst supported on alumina. The reforming reactions take place at 1,000 to 1,070 deg. F. and 150 to 300 psi.

Fixed-bed Hydroforming units contain several reactors; cyclic regeneration of the catalyst is thus possible without shutdown of operations. An improved fluid-bed version of this process has recently been announced. It uses a fluidized, rather than a fixed, bed of molybdena catalyst: the catalyst is continually regenerated in a separate vessel rather than in the reactor at periodic intervals. The recently announced Thermofor catalytic reforming (TCR) process uses a chrome-alumina catalyst and is similar to the Thermofor catalytic cracking (TCC) process in that both processes employ continual regeneration of the catalyst.

At the present time, however, most of the Platinum aromatics from petroleum hydrocarbons are pro- catalysts duced by processes utilizing fixed-bed nonregenerative catalysts, of which platinum is usually the principal active component. The Platforming process, developed by Universal Oil Products Co., is the most widely used of these processes. The reactions take place at approximately 900 deg. F. and pressures of 250 psi. (for aromatics production); the catalyst is in the form



of platinum-base supported pellets. Aromatic yields are reported to be 75 to 90 percent of theoretical.

Atlantic

The Atlantic Refining Co.'s reforming process process is similar to the platforming process in that it utilizes a platinum catalyst. Houdriforming is another recently announced process used for the production of aromatics.

> It is significant to note that all of these processes were originally developed and can be used for improving the octane rating of petroleum naphthas and gasolines. Many refiners, in fact, are able to switch their production at will from chemical-grade aromatics to high-octane gasoline components.

> Aromatics were originally recovered from the product streams from the reforming units by super-fractionation techniques. The increasing utilization of these reforming processes for the

manufacture of chemical-grade aromatics (for which purity requirements are much higher than for octane aromatics) has, however, resulted in the development of improved separation processes. The principal ones in commercial use at the present time are:

Udex Extraction with diethy- Recovery lene glycol Extractive distillation Shell with phenol Arosorb Adsorption on silica gel, followed by desorption (cyclic process)

SO: The U.O.P. Platforming-Udex unit flow diagram presented here is typical of the processes used for the manufacture of aromatics.

Extraction with liquid

Modified Edeleanu

anhydride Vent aas (to purification) incinerator

#### Oxidation of Xylenes

Phthalic

Exothermic

Until about five years ago, phthalic anhydride was made only by the oxidation of naphthalene. Although this process still accounts for the bulk of the production, of increasing importance is the manufacture of phthalic anhydride by oxidation of ortho-xylene.

In this process ortho-xylene and air are passed over silica- or alumina-supported vanadium pentoxide catalyst. To avoid operating in the explosive range, about ten times the theoretical quantity of air is used, at temperatures over 1,000 deg. F., at approximately atmospheric pressure, and at contact times of less than one second.

The oxidation reaction is highly exothermic reaction and care must be taken to prevent overheating of the catalyst, with the resulting possibilities of explosion and fire. This is done by placing the catalyst in the tubes of vertical multi-tube reactors. As ortho-xylene and air flow down through the tubes, fused salt is circulated through the shell and around the tubes of the reactor and the heat is removed from the salt in a waste-heat boiler.

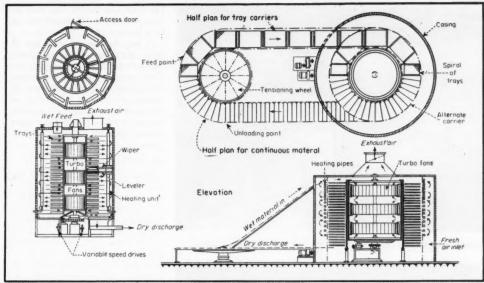
The oxidation products are first cooled in heat exchangers by hot water and are then piped to large, box-like, air-cooled condensers where the

phthalic anhydride condenses from the gas in long needle-like crystals. As the crystals grow in size on the walls and roofs of the chambers, they eventually fall into hoppers from which they are removed periodically. The crystalline product is melted by closed steam-coil heating and is purified by two-stage vacuum distillation. Yields are estimated to be 80 to 85 percent of theoretical.

One plant in the United States has, since Fluidized 1944, manufactured phthalic anhydride by the bed oxidation of naphthalene in a fluidized bed. It is reported that several manufacturers are giving consideration to using a fluidized bed for the manufacture of phthalic anhydride from ortho-xylene.

Para-xylene is another xylene of commercial Tereimportance, as it is the raw material required phthalic for the manufacture of terephthalic acid, re- acid quired for DuPont's Dacron polvester fiber. Although no process details on the manufacture of terephthalic acid have been released, it is believed possible to manufacture it from para-xylene by a process similar to the one used for the manufacture of phthalic anhydride from ortho-xylene.

processes



TWO MAIN TYPES of turbo-type dryer: vertical rotary at the left, and endless carrier at the right.

## What's Doing in Turbo-Type Dryers?

Although used extensively throughout the world, turbo-type dryers have had little literature attention and are not well known outside their users. This article surveys uses, performance, characteristics.

#### M. J. BERSON

Turbo-type dryers were developed about two decades ago in Germany. Although they are now made by equipment concerns in four countries, and there are nearly 850 installations, they are still not very well known. Interviews with many users during a recent six-months survey of foreign industrial developments showed this to be the case. At the same time the discussions showed types of use, some of the results, and some of the reasons for well established acceptance of the dryer on the part of those process engineers who know it.

Common to all turbo-type dryers are the centrally located turbine fan wheels which provide intense circula-

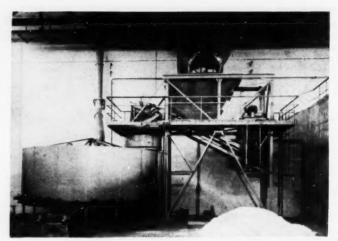
M. J. Berson, Berkeley, Calif., is a research engineer with one of the large western railroads. On a recent "busman's holiday" in Europe he spent six months in making a survey of foreign industrial developments.

tion of the drying medium over the material to be dried. Around these fans the material is carried through the dryer. Of the many types developed, two have been widely accepted, namely the "vertical rotating tray" or "transfer" type—much the more common—and the "endless carrier" or "spiral" type. The rotary tray type has a vertical series of superimposed

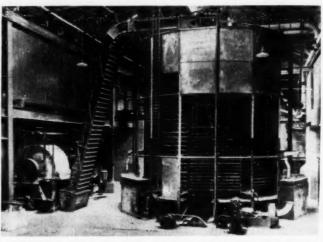
Table I-Materials Being Dried on Turbo-Type Dryers, and Number of Installations
(Only those having two or more installations included)

Inorganie	Sodium bicarbonate	2	Corn prods., not in-	
	Sodium sulphate	6	cluding starch	
Aluminum hydrate 3	Superphosphates	2	Dextrose	3
Aluminum hydroxide.	Table salt	5	Fish	
Aluminum sulphate 16	Welding electrodes	3*	Food	
Argiliaceous earth 3	White lead	3	Grain	
Barytes 4	Zinc oxide	9	Glue, pearl	
Bleach soda 2	Zinc oxide	4		
Bleaching clay 8	Organic		Hemp	19-
Calcium carbonate 4	Organic		Herring, smoked	
	Activated carbon	0	Mordants	
Catalyst 12		2	Pharmaceuticals	
Clay 4	Albumin	3	Potato slices	14
Detergents 20		5	Rubber agents	2
Dicalcium phosphate. 6	Bluing, laundry	2	Rubber, reclaimed	2
Fullers earth 10	Boards, fiber	5.	Rubber, syn., Buna	
Glass sand 2	Boards, binder	5.	Salicylic acid	
Lead arsenate 3	Bread, bread prods	. 2	Starch, all kinds	
Lithopone, crude 11	Casein	9	Sewage sludge	
Lithopone, refined 11	Cellulose acetate	e		
			Sugar	21
Magnesium carbonate 11		23	Urea plastics	
Red mud (alumina		36	Vegetables	21
waste) 14			Vinyl plastics	4
Oil shale 6	Copra	5	Yarn cakes	3.0

<sup>·</sup> Spiral type dryer used. All others are vertical rotating-tray type.



AMMONIUM CARBONATE is handled in this dryer made by Buettner Works.



MAGNESIUM CARBONATE is dried in this English dryer of Buell Combustion.

shelves or trays rotating around a central turbine fan. The material to be dried is transferred from one tray to the next below through radial gaps between the trays, the material remaining on the tray for one revolution before it is transferred and levelled on to the next tray. In the "endless carrier" type, the material is conveyed on screen-bottom trays forming an endless carrier which passes through the dryer in a close-pitched spiral, entering at the top and leaving at the bottom for unloading as the carrier passes around a tensioning wheel where it is reloaded for another entry.

The first type has found extensive use for granular materials, powders, crystals, sludges, and thick slurries, whereas the spiral type has proved desirable for materials which cannot be disturbed during drying and require a very long drying time. Table I shows some of the applications of each type of dryer.

Turbo-type dryers are made by the following firms: The Buettner Works of Uerdingen, Germany, who first developed the turbo and now has by far the greatest number of installations, well in excess of 650; the Etablissements G. Vernon of Paris;

The Buell Combustion Co., Ltd., of London; and the Wyssmont Co. of Long Island City, N. Y.

As may be expected, each one of these firms has developed special adaptations of the dryer to solve particular problems but, of the nearly 850 turbo-type dryer installations, 90 percent are either of the vertical rotating-tray type or the endless-carrier type, as these have proved highly versatile and adaptable to a wide range of products.

#### ADVANTAGES, LIMITATIONS

Opinions solicited both from the manufacturers and the users about the performance of the dryer revealed several notable advantages. Apparently turbo-type dryers are able to handle a wide variety of material. They can handle heavy slurry and sludges, but not wet feed of liquid consistency. They can also handle pasty and caking materials, provided these become friable during drying. Granulated and powdery material are handled without limitations.

The turbo-type dryer does not seem to be able to compete cost-wise with the rotary dryer when the shortcomings of the latter are not an issue. However, if the rotary dryer has to be built of expensive material because of contamination or corrosion, the cost may turn in favor of the turbo-type dryer.

In Europe especially, where the high cost of energy can make the power consumption an item of appreciable expense, the low power requirement of the turbo-type dryer is of importance. For example, a starch dryer with a capacity of 50 tons per 24-hr. day requires less than 20 hp. to reduce moisture from 35 to 12.5 percent. Another example is a dryer handling clay which requires 33 net hp. for 5 tons per hr. of product reduced from 30 to 10 percent moisture. Steam consumption was found to run from 1.7 lb. of steam per pound of water evaporated, in the case of corn starch and china clay, to about 2.5 lb. of steam per pound of water for the more crystalline products with low initial moistures. The reheat cycle employed in all turbo-type dryers that are internally heated accounts for the low steam consumption. Table II shows typical performance data for ten dryers all operating on different products, with different moisture conditions.

Some users claimed that, at least for their particular products, the outstanding feature is the fact that dust losses are negligible. Turbo-type dryers operate invariably without dust collectors. This is possible because of low air throughput and low velocity of air or gases leaving the dryer, combined with the scrubbing effect of the wet layers of material over which the air must pass before it can leave the dryer.

Furthermore, the stack effect of the turbo-type dryer permits maintaining a slight negative pressure throughout the dryer, thus preventing dust or obnoxious fumes from escaping to the surrounding space.

Users of the rotary tray type for drying fragile crystalline products claimed that, because of the gentle piling and spreading action to which the material is subjected in the dryer, the degradation is less than 0.5 percent and only a negligible quantity of fines is produced.

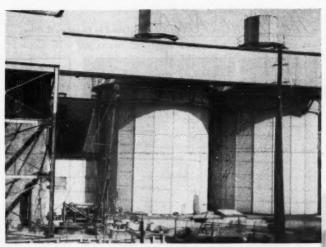
Those who used the dryers for sludges and like material, which tend to ball or smear and build up, claimed that they were able to handle such materials without back-feed.

The ability to hold gas leakage to a minimum was mentioned repeatedly. In several instances, the leakage was less than 0.5 percent of the throughflow.

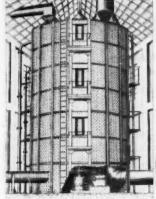
#### NON-DRYING USES

Besides the common use as a dryer, I also came across installations in which machines of the rotary-tray type were used as coolers, as continuous sublimers, as contactors, as freezers, as smokers, and to recover solvents from products after extraction.

The most common size seemed to be between 1,000 and 3,000 sq. ft. net tray area, measuring between 13 and 20 ft. in diameter and from 15 to 25 ft. high. The smallest unit is only 6 ft. in diameter and 6 ft. high. Small units intended originally for pilot plant purposes are being used in surprisingly large number for production, even though their small output might suggest that they could not be economically justified. Quite a number of the larger installations have units 35 ft. in diameter, the tallest ones being 60 ft. high, with evaporative capacities in excess of 20,000 lb. of water per hour. These giant dryers are usually erected out-of-doors.



SEWAGE SLUDGE is dried at Milwaukee in this dryer built by Wyssmont Co.



BRICK enclosure is an unusual feature of PACKAGED construction by Wyssmont a dryer built by Etablissements G. Vernon. is a feature of this small catalyst dryer.

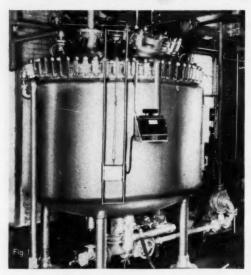
Table II-Performance of Typical Turbo-Type Dryer Installations

(All dryers were without dust collectors and all were internally heated except as noted; all moisture contents are reported on the wet basis.)

		Feed		0	utput	Size, Ft.,	Total	Heat Supply,
Unit No.		Material	Moisture, Percent	Tons	Moisture, Percent	Diam. x Ht.	Power, Hp.	Lb./Hr. Steam @ psig. Noted
1	England	Cornstarch	35	602	12.5	24x281	23	3,200 @ 60
2	England	Mag. carbonate	80	401	1.5	24x26	28	3,400 @ 10
3	England	Urea formal- dehyde	38	181	5.0	15x14	11	260 @ 10
4	England	Porcelain clay	30	21	1.0	28x24	33	3,200 @ 68
5	U.S.A.	Silica gel	75	0.051	12.0	6x10	11	500 @ 190
6	U.S.A.	Alumina gel	56	0.51	0.1	14x17	54	1,900 @ 125
7	U.S.A.	Sewage sludge	84	61	52.0	35x53	65	
8	U.S.A.	Salt	3.3	1501	0.1	14x17	6	1,350 @ 235
9	Germany	Conl <sup>3</sup>	18	601	3.0	33x30	50	
10	Italy	Cellulose ac.	65	0.1331	2.0	14x16	10	850 @ 25

<sup>&</sup>lt;sup>1</sup> Per hr. <sup>3</sup> Per 24-hr. day. <sup>3</sup> Per 168-hr. week, gas/lb. water evap. <sup>5</sup> Low grade bituminous, 3/8 x 0. <sup>4</sup> Heated by flue gas using 3 cu. ft. of 545-Btu. <sup>6</sup> Heated by flue gas using 2 cons 10,500-Btu. <sup>6</sup> Heated by flue gas using 2 cons 10,500-Btu.

## The Plant Notebook Edited by Theodore R. Olive



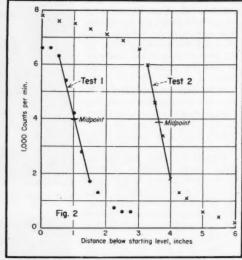
#### Radiocobalt Level Gage Measures Contents of Closed Systems

STANLEY L. EISLER, Radiochemist, Ordnance Corps, Rock Island Arsenal, Rock Island, Ill.

#### \* July Contest Prize Winner

Our problem was to measure the level of chromic acid solution in a glass-lined kettle which is part of a deionizing unit for removing contaminants from chromium plating solutions. This kettle, used as an evaporator, was not supplied with a gage glass or other level viewing device because, operating under vacuum, there is inherent danger in breaking the glass. It was impractical to add a glass due to the inadvisability of breaking into the glass-lined piping. The extreme corrosiveness of the chromic acid solution made it undesirable to install any kind of level measuring equipment within the kettle. The best solution, therefore, seemed to be the use of an external radioactive level gage.\*

Two types of radioactive level gage have been mentioned in the literature. One has a radioactive source mounted in a float on the surface of the liquid, with a detector on top of the tank. The distance between float and detector determines the counting rate. This type was not used because of the desire to keep equipment out of contact with the solution. The second type of gage has a source outside the tank, with a detector mounted outside, on the opposite side. This was chosen



as the best type for this case. The theory of this type gage according to Aebersold (Mech. Eng., 71, 987, Dec. 1949) is that, with source and detector at the same height, a part of the gamma radiation is absorbed as the level of liquid rises between the two elements, thus giving a marked decrease in the measured radiation.

For this installation we secured a piece of irradiated cobalt wire 1 in. long and 1 mm. in diameter from the Isotopes Division of AEC at Oak Ridge National Laboratory. Its activity was about 36 millicuries. We then designed a method of mounting the source and detector on opposite sides of the evaporator so that they could be raised or lowered simultaneously and always at the same height. Calculations showed that the source should be shielded on all sides, except the tank side, by 3 in. of steel. Therefore, both source and detector were mounted in steel blocks 6 x 6 x 3 in. deep, with the inner face shaped to the tank contour. The source was recessed into one of the blocks and held in place by an aluminum plate. The detector tube was recessed into the contoured face of the other block. A drum and pulley arrangement powered by a ‡-hp., 1,750 rpm. reversible motor through a 200:1 reducer was installed on top of the evaporator for raising and lowering the blocks on guide rails, as in Fig. 1. By means of momentary-contact "up" and "down" pushbuttons the operator easily locates the blocks at any desired elevation. The detector, shown in Fig. 1, is a Keleket Model K-900 radiation monitor with a 30 mg./sq. cm. aluminum wall Geiger-Mueller tube.

To determine any possible radiation hazard we made tests with a pocket dosimeter placed 3 ft. behind the source, and 4 ft. to the side. Exposures of 5 hr. each gave an average of 9 milliroentgens per hr. in the first position, and about 4.5 milliroentgens per hr. in the sec-

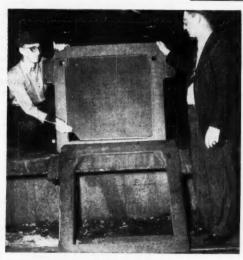
Opinions presented are the author's, and not to be construed as official or reflecting views of the Department of the Army. The author expresses appreciation to his coworkers for their assistance, and to the Ordnance Corps Research and Development Division of the Department of the Army, and the Laboratory supervisory staff, for permission to publish information in this article.

ond. A worker would have to stand for 5½ hr. a day, six days a week within 3 ft. of the source to receive the maximum permissible exposure of 300 milliroentgens per week, so any hazard was considered most improbable.

In checking the sensitivity of the gage we made two test runs, results of which are plotted in Fig. 2. In each case the source and detector were raised above the liquid level until the maximum counting rate was attained. Then the instruments were lowered at ½ in. intervals and readings taken at each level after reaching equilibrium. In each case the starting point was called 0 in the plot, but in the first test the initial reading was not taken high enough above the liquid level to get the true maximum reading. Both curves show a marked decrease of about 70 percent in counting rate within a distance of ½ in., with this portion of the curves linear. Since in theory the gamma quanta beam should decrease uni-

formly on both sides of the dead center of the beam, we may assume that the liquid level lies at the midpoint of this linear portion of the curves. For both tests the counting rate at the midpoint was substantially the same and the curve for Test 2 shows that a counting rate of 50 percent of the maximum is a good criterion for the liquid level.

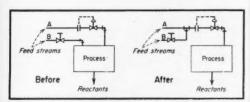
This is the way the gage is now being operated. The operator uses the touch control buttons to lower the source and detector until a meter reading of half the maximum is obtained. With reasonable care the final adjustment may be made within 1 in. Since the 500-gal. evaporator contains about 12.5 gal. per in. of depth, this means a reading accuracy within 3-4 gal., or better than 1 percent accuracy at full capacity. The percent error is greater, of course, at lesser capacities, but is good enough for the degree of accuracy needed.



**Broken Rubber Press Plates** Converted to Frames

At Du Pont's Chambers Works, Deepwater Point, N. J., they are now salvaging broken rubber filter press plates by cutting out the broken center and using the edge portion as a frame. The damaged center portion is cut out with a saw and the outlet plugged by cementing in a rubber stopper. The operation costs very little and saves the cost of new frames which might otherwise have to be purchased.

The idea is that of operator Wayne R. Galey, who also has had several other original ideas accepted for use. In the view above he is showing a broken plate to his general foreman. Below it is a frame salvaged from a similar damaged plate.



#### Process Kinks Help Out in Plant Emergencies

WILLIAM H. TELL, Diamond Alkali Co., Houston, Tex.

Here are a couple of handy process "kinks" to tuck away mentally for possible emergency use.

Sometimes in operating a plant it is found necessary to use flow control on one or more liquid (or gaseous) reactant streams than was contemplated in the process

#### \* August Contest Prize Winner

"Wire-Inserted Sock Makes Troubleproof Connection for Vibrating Equipment."

A prize of \$50 in cash will be awarded to S. R. Nemeth, mechanical engineer, technical section, Sabine River Works, E. I. du Pont de Nemours & Co., Orange, Texas. His article will appear in October.

\$50 PRIZE FOR A GOOD IDEA-Until further notice the Editors of Chemical Engineering, will award \$50 cash each

month to the author of the best short article received that month and accepted for publication in the Plant Notebook. Each month's winner will be announced the following month and published the second following month.

\$100 ANNUAL PRIZE—At the end of each year the monthly winners will be rejudged to determine the year's best Plant Notebook article, which will then be awarded an additional \$100 prize.

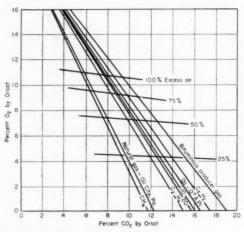
HOW TO ENTER CONTEST-Any reader of Chemical Engineering, other than

a McGraw-Hill employee, may submit as many entries for this contest as he wishes. Acceptable material must be previously unpublished and should be short, preferably not over 500 words, but illustrated if possible. Articles which are acceptable but are not winners will be published at regular space rates (\$10 minimum).

Articles may deal with plant or production "kinks," or novel means of presenting useful data, which will interest chemical engineers. Address Plant Notebook Editor, Chemical Engineering, 330 West 42nd St., New York 36, N. Y.

design. As a temporary expedient in such a case a single flow controller can be made to do the work of two as the sketches above indicate. The lefthand sketch shows the original set-up in which it was found that stream B also needed control. By revising the process flow as in the righthand sketch it is possible to obtain positive regulation of both process streams. To make the valve setting it is necessary to determine the specific gravity of the two feed streams and of the mixture. Note that this arrangement is satisfactory only if both streams are liquid, or both are gas, but not if one is gas, the other liquid.

Another useful trick helps to hold the temperature of a batch during in-process storage. Sometimes in batch processes an external cause such as a breakdown makes it necessary to discontinue processing before the reaction is complete and transfer material at high temperature to an uninsulated temporary storage vessel. If the heat loss can be reduced, there will be less delay in reheating on resuming the process. One simple method of cutting the heat loss is to make use of the insulating effect of a foam blanket on top of the open tank. For this purpose any of the ordinary detergents, in general, which will produce a maximum of froth with a minimum of agitation, is satisfactory in minimizing heat loss.



## Chart Gives Quick Check of Orsat Analyses

Russell H. Herman, Esso Engineering Dept., Standard Oil Development Co., Linden, N. J.

Every engineer who has had to obtain furnace flue gas analyses with an Orsat set, or who has used these analyses, recognizes the advantage of having a quick method of checking them. The attached chart serves this purpose.

By use of the chart, the engineer can not only find out whether the analysis is reasonable, but can also readily estimate the amount of excess air being fired. The percentage of O<sub>2</sub> in the dry flue gas is read on the ordinate, and the percentage of CO<sub>2</sub>, as given by the Orsat, is read on the abscissa. This CO<sub>2</sub> reading also includes any SO<sub>2</sub>

present. Corrections for normal sulphur in the fuel have been made for the lines on the chart. The amount of excess air may be obtained from the parameter lines. In constructing the chart, it has been assumed that no CO is formed. This is true for all practical purposes except at very low excess air rates.

To illustrate the use of the chart, let's take the case of an engineer in Oil City, Pa., who has just obtained two Orsats of the flue gas of a furnace firing natural gas:

	10000000	-Percent	-
	CO:	Oz	CO
Sample No. 1	8	5	0
Sample No 2	10	A	0

The chart readily shows that the engineer cannot trust his first analysis because the point does not fall on the line for his fuel. He can see that the second analysis checks, and that about 22 percent excess air is being fired.

Lines for two representative fuel gases<sup>1</sup> and several grades of fuel oil<sup>2</sup> are included on the chart. Methane, ethylene, and acetylene have also been included to illustrate the effect of the carbon-to-hydrogen ratio of the fuel.

For approximate work, the line to be used for any given fuel may be estimated from those already on the chart. For more accurate work, the exact line may be drawn by locating on the abscissa the sum of the percent  $CO_2$  and percent  $SO_2$  in the dry flue gas at 0 percent excess air, and then connecting this point with 21 percent  $O_2$  on the ordinate by linear extrapolation).

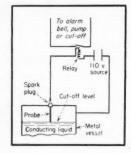
Perry, J. H., "Chemical Engineers' Handbook," 2nd ed., p. 2363, McGraw-Hill Book Co., New York, 1941.
 Esso Blue Book, Std. Oil Devel. Co., New York.

#### Pressure-Tight Electrical Lead Made From Spark Plug

ALLEN E. MEYER, Central Research Laboratory, Allied Chemical & Dve Corp., Morristown, N. J.

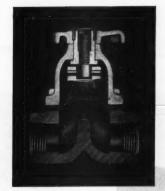
It frequently is necessary in pilot plant work to introduce an electric potential into a pressure or vacuum vessel. Although there are many commercial devices on the market for accomplishing this, they may not be available on short notice.

We have frequently used a common automobile spark plug, slightly modified, for this job. It



can be threaded into the vessel, providing a leak-proof seal up to 100 psi. The modifications necessary are simple. First, the ground terminal of the electrode must be removed. The other terminal may then be used to make the connection. A suitable connector may be soldered or brazed on for convenience in attaching the power lead inside the vessel. The vessel itself is the ground side of the circuit. The plug may also be used for controlling or indicating the liquid level of a conducting liquid, as shown in the illustration. For this purpose a length of brass or steel welding rod may be soldered on as a probe.

# now!



## diaphragm valves

... of chemical-resistant

# ACE SARAN or PARIAN (Polyethylene)



Here's an all-purpose valve that combines the unique corrosion

resistance of Ace plastics with the efficient Saunders diaphragm principle . . . a valve that cuts costs wherever corrosive liquids or gases are handled at normal temperatures and pressures.

Body is molded of Ace Saran or Parian. Diaphragm may be rubber, neoprene or polyethylene. Corrosives never touch metal. Bonnet assembly is sealed off from the solution. No stuffing box to leak. It can be serviced without removing from line – all parts are interchangeable. All sizes from ½ to 2 in., standard pipe threads. Working pressure 50 psi. at 77 deg. F.

Use Ace Saran and Parian pipe and fittings too, to make a completely protected system. You'll also be interested in the complete line of Ace hard rubber and rubber-lined chemical equipment. Write today for bulletins.

## ACE ACE SARAN

Sulfurio acid, come.
Sulfurio acid, 60%.
Sulfurio acid, 30%.
Sulfurio acid, 30%.
Sulfurio acid, 10%.
Inydischiprio acid, 10%.
Inydischiprio acid, 10%.
Initial acid, come. (70%).
Initial acid, come. (70%).
Initial acid, come. (70%).
Initial acid, come. (70%).
Initial acid, 10%.
Initial acid, 10%.
Initial acid, come.
Sulfurio acid, 48%.
Initial acid, come.
Sulfurio acid, 50%.
Sulfurio

REAGENT

Calcium chlaride,
15% eq.
15% eq.
15% eq.
15% eq.
17/ethanolamine
Campher Oil
Ferric aulfate, 15% eq.
Lioseed Oil
Fermic acid

o This is partial list only ... ask for complete data.

RATING

Good Excellen Excellen

Good
Unsuitable
Fair
Unsuitable
Poor to Fair
Fair to Good
Unsuitable
Good
Good

Unsuitable
Unsuitable
Unsuitable
Fair
Unsuitable
Excellent

Excellent
Excellent
Unsuitable
Excellent
Fair
Good

SARAN

Excellent Excellent Excellent

Excellent tood
Excellent Excellent Excellent Excellent Excellent Excellent Excellent

Expellent
Fair
Good
Excellent
Fair

et Excellent Excellent Excellent Good Excellent Good

Sun although

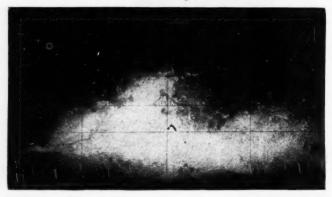
TO MOTE CHEMICALS

ACE rubber and plastic products

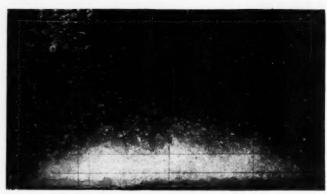
AMERICAN HARD RUBBER COMPANY
93 WORTH STREET . NEW YORK 13, N. Y.

## Process Equipment News Edited by Calvin S. Cronan

#### NEW PROCESSING EQUIPMENT



BUBBLE cap tray contact zone.



GRID tray contact zone; same tray size, spacing and vapor-liquid rates.

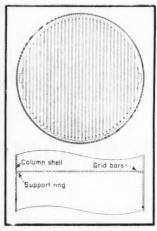
### **Grid Trays Boost Tower Output**

New tray design—now available to industry for the first time—provides higher column capacity, longer tray life, easier maintenance, lower cost.

Bubble-cap distillation trays, used and improved for almost a century, face serious competition from a new tray design recently developed by Shell Development Co. and affiliated Shell laboratories.

Compared to well designed bubblecap trays, Shell claims Turbogrid trays have 20 to 100 percent greater capacity, about 80 percent less pressure drop per tray and about the same separation efficiency per foot of column height. Turbogrids show their greatest capacity advantage in columns having high liquid loads.

Column shell costs show reported savings of 30 to 45 percent. Because of design simplicity tray costs alone are only about half those of conventional design.



TOP view and cross section of grid tray.

Bubble-cap columns will still have an edge, Shell concedes, on two counts: When an appreciable holdup time is required to allow a chemical reaction to proceed to completion; and when design allowances must be made for a wide range of throughput loads. Grid-tray columns have a higher minimum throughput requirement which holds them to a narrower operating range than that for comparable bubble-cap columns.

Turbogrid trays are extremely simple; consist merely of a flat grating extending uniformly over the entire column cross-section. Openings in the grating are parallel slots of appropriate length, width and number. In no sense a modification of conventional trays, grid trays resemble sieve trays in that they contain no bubble cap assemblies nor liquid downcomers; both vapor and liquid flow uniformly through the slots.

Since grid trays do not contain the riser, or reversal and annular vapor passages of bubble caps their friction loss and total pressure drop is lessened significantly, and vapor capacity is increased accordingly. The dry pressure drop for grid trays is only 1/25th that for bubble-cap trays. Operating pressure drops of 1 mm. Hg or less per tray can be obtained while still maintaining good efficiency, it is claimed.

#### **Equipment Cost Indexes**

(Marshall and Stevens Indexes of Comparative Equipment Costs, 1926 = 100)

1020 =	100)		
Industry Average of all	June 1951 180.9	Mar. 1952 180.2	June 1952 180.3
Process Industries			
Cement mfg	173.1	172.8	172.6
Chemical	181.1	180.8	181.0
Clay products	168.1	167.8	167.6
Glass mfg	171.2	170.9	170.7
Paint mfg	174.4	174.1	174.3
Paper mfg	174.7	174.4	174.6
Petroleum ind	177.5	177.2	177.4
Rubber ind	179.9	179.6	179.8
Process ind. avg	178.5	178.2	178.4
Related Industries			
Elec. power equip	182.7	182.4	182.6
Mining, milling	181.8	181.5	181.7
Refrigerating	200.5	200.3	200.5
Steam power	170.3	170.0	170.3

Compiled quarterly for March, June, September and December of each year by Marshall and Stevens, evaluation engineers, Chicago and Los Angeles. Indexes are prepared for 47 different industries, from which the eight process and four related industries listed here are selected. Published each month with the latest available revision. For a description of the method of obtaining the index numbers see R. W. Stevens, Chemical Engineering, Nov. 1947, pp. 124-6. For a listing of annual averages since 1913 see Chemical Engineering, Feb. 1952, p. 191.

Absence of downcomers and crossflow liquid resistance gives grid trays higher capacity where liquid flow is controlling. Liquid holdup occurs, but for equivalent separation this holdup is much less than on bubble-cap trays.

Turbogrids have lower tray efficiencies, yet greater tray capacities make lower tray spacings possible. More trays can thus be installed in a given height, resulting in comparable fractionating efficiencies per foot of height. Tray spacing can be as little as 6 in., with normal spacing running from 12 to 18 in.

Operation and control of Turbogrid towers is said to be easy. They react rapidly to changes in conditions because of low holdup. Momentary surges can be accommodated readily since temporary overloads are rapidly dissipated. Throughput changeovers which usually take about 8 hr. in bubble-cap columns can be made in 2 to 3 hr.

Maintainance-wise the Turbogrids possess several advantages. Stamped, corrosion-resistant thin-gage alloy trays give long life at approximately the same cost as carbon-steel bar-stock grid trays. Turbogrids foul less rapidly than conventional trays—there are no dead zones, and slot widths may be varied over wide limits to meet severe fouling or corrosion conditions. The

IN BRIEF-A capsulated listing of this month's newsworthy equipment.

Processing Equipment	1 46
Distillation Trays Porous Metallic Ceil Twin Shell Blender Ultra Centrifuge Gyratory Screen Pulverizer Mill Mixer and Agglomerator	Grind type, up tower output
Instruments & Controls	
Temperature Controller Strip Recorder Viscosimeter Automatic Tank Gage Spectrophotometer Recording Fotentiometer Static Detectoral brator Temperature Regulator Water Vapor Indicator Color Sorter Flow Indicator Refractometer	Resistance bulb type, controls wide range. 189 Features 30 day chart, has six hour visibility. 189 Measures solutions without fouling. 189 Have resolutions without fouling. 189 Have resolutions without fouling. 189 Have resolved
Fluids Handling Equipment	
Leakproof Pump Rubber Hose Centrifugal Pump Centrifugal Pump Turbifugal Ram Fund Metering Pump Centrifugal Compressor Flow Regulator Heated Valves Pipe Coupling Acid Hose Downflow Purifier Industrial Fam Diaphragm Valve Pipe Coupling Clamp	Combines motor and impeller in one housing 187 Now consolidated from 18 to 5 types. 187 Double suction type with mechanics scale. 187 Double suction type with mechanics scale. 188 Delivers constant flow under varying head. 188 Delivers constant flow under varying head. 188 Goosts gases in high pressure systems. 188 Boosts gases in high pressure systems. 188 Now modified for greater accuracy. 188 Can operate down to -110 deg. F. 190 Threadless type for 2,000 psi. 191 Newly developed for strong acids. 193 Cleans vapors entering process vessels. 193 Can move air and solids up to 44,000 cfm. 193 Now furnished with polyethylene body. 183 For heavy lines, speeds tanker unloading. 193
Electrical & Mechanical Equi	
Gear Motor Brake Motor Protective Relay Air Transformer Power Saw Electric Fixtures Bushing Extractor Safety Wiring Multi-Speed Transmission Elastic Piston Seal Drainage Gutters	Offered in 5 to 25 hp. range. 194 Has been built into line of transmissions. 194 Gives accurate, reliable protection. 194 Offers easy, close pressure regulation 194 Designed for quick, easy cutting of pipe. 194 Explosion-proof for flush mounting. 194 Removes bushings from blind holes. 195 Has mineral insulation, metal sheathing. 195 Now available with 4 speeds up to 50 hp. 186 Eliminates closely machined tolerances. 1946 Come pre-fabricated, ready to install. 197

trays are actually partially self-cleaning.
The record of development study and commercial acceptance furnishes

final proof of the worth of this development. Since 1945 Shell has devoted 30 man-yr. of time to the perfection of Turbogrids. Data have been collected covering pressures from 20 in. Hg vacuum to 300 psi., vapor densities from 0.04 to 2.8 lb. per cu. ft., liquid-vapor density ratios from 10 to 1,000, and vapor-liquid volume flow

ratios from 5 to 10,000.

Twenty Turbogrid columns are now in operation with more than 40 under construction. The first two columns were installed in August 1950 for alcohol stripping and depropanizing. Stripper tray life was 24 months, doubling bubble-cap life expectancy, and the depropanizing trays are still in operation without maintenance.

Other units have been installed for service as ethylene purifiers, debutanizers, chlorinated hydrocarbon fractionators, C.-C., fractionators, sour water strippers and chlorohydrin strippers. Columns now under construction are to be used in crude aromatics recovery, and catalytic cracking gas recovery units; natural gasoline, ammonia and chemical plants.

Turbogrid trays are now being offered to industry under license.—Shell Development Co., 50 West 50th St., New York, N. Y.

#### Porous Metallic Cell Disperses and Filters

A porous stainless steel cell mounted on a shaft rotating at high speed acts as a liquid and gas disperser, a mixer and a batch filter. This unit consists of two saucer-shaped disks which are mounted concentrically facing each other on the rotating shaft. Standard size units are 2\(^x\) in. O. D.— Equipoise Controls, Inc., P. O. Box 269, Bronxville, N. Y.



#### Twin-Shell Blender With Intensifier Bar

A newly designed rotating intensifier bar has been added to the Twin-Shell blender to improve mixing action. The lug-studded bar effectively breaks up lumps, disperses materials which tend to agglomerate, and homogenizes liquids into solid mixes.

The intensifier bar is so located that the cylindrical lugs act only on the top layer of the material being mixed. Rotation of the blender continuously supplies fresh material to the impact and shearing action of the lugs, whose peripheral speed is approximately 2,500 ft. per min.

The metal bar is belt-driven by a separate motor. Power requirements are small, since the bar acts only on the top layer of material. The bar is easily removed for cleaning by pushing it toward the spring-loaded end and sliding it from its sockets. It is currently available on all units up to 60 cu. ft. size.—Patterson-Kelley Co., 442 Warren St., E. Stroudsburg, Pa.

#### Ultra Centrifuge Handles Batch Samples

A newly designed rotor for the Spinco Model L preparative ultra centrifuge can handle batch samples as large as 1600 ml. Material can be ultra centrifuged up to 20,000 rpm. under controlled temperature conditions. At this speed material is subjected to maximum and minimum centrifugal forces of 43,380 and 16,770 times gravity respectively.

Rotor was designed to speed up preparative runs on sedimenting materials which pack readily. Since all parts can be easily sterilized, the machine lends itself to materials which are infectious or require sterile handling.

Rotor consists of main bowl, a removable central core which prevents sloshing minimizing unbalance and resuspension, and a lid handle assembly.

Central core includes two filling holes with plugs. Easily controlled discharge of the supernatant fluid is secured by substituting plastic tubing for these plugs.

Packed sediment is extracted with a plastic scraper. If resuspension of solids is desired, stainless steel balls are placed inside rotor while rotor is rolled on a motor-driven roller fixture. Following this, the steel balls can be removed by a magnet.

Rotor has a loaded weight of 22 lb. and accelerates to 20,000 rpm. in 9 min. — Specialized Instruments Corp., 628 O'Neil Ave., Belmont, Calif.



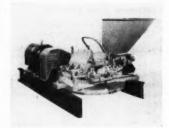
#### Vertical Circular Screen Rotates and Gyrates

By combining gyratory movement with centrifugal action equivalent to five times the force of gravity the Symons V screen is said to have high screening capacity and be able to screen material heretofore considered unscreenable.

The cylindrical screen mounted vertically measures 3 ft high x 12 ft in circumference. This unit is completely enclosed, assuring dustless operation.

A cupped feed plate with radial vanes located a little below the upper edge of the screen drum directs entering feed against the inner drum surface. A ratio of 14 gyrations to each drum rotation joggs the material against the inner surface, greatly aiding the screening action.

Either fabric or metal screen cloth may be used. Where required, water sprays are mounted in the lower assembly for wet screening operations.— Northberg Mfg. Co., Milwaukee 1, Wie



#### Pulverizer Mills Now Made in Large Sizes

The Pulva-Sizer line of hammer impact mills has been increased in number by the addition of the new, larger sized Models C and D. These mills employ high speeds and close clearances for ultra find grinding. Granulating operations are carried out through the use of knife type hammers and low speeds with controlled clearances.

Among the advantages claimed for these new units are twin feed screws in sizes from 1½ in. to 4 in. dia. to handle a wide range of feed sizes and types, drop forged hammers suitably protecte by hard-surfacing alloys, and quick opening hinged covers for ready access to the grinding chamber.

The largest size machine can use up to a 100 hp. motor. Operation can be continuous 24 hr. per day, 7 days per week.—Pulva Corp., 551 High St., Perth Amboy, N. J.

#### Mixer and Agglomerator Operates Automatically

Recently displayed at the Achema in Frankfurt-am-Main was a further development of the Eirich mixer. Previous model of the Eirich mixer is a pan-type machine capable of mixing and agglomerating one-half to one-ton batches of material. A typical pan is 7.5 ft. in diameter and 18 in. deep. Eccentric mixing blades mounted inside the pan agitate the charge as pan and blades rotate in opposite directions.

New machine has been designed for completely automatic operation. This includes feeding correctly weighed ingredients to mixer, as well as discharge of the finished material to subsequent operations. Automatic alarms signal any variation from standard operation.—Gustav Eirich, Hardheim, Germany.

## THE CARE AND NURSING OF TANK CARS



## Another way to get more from your GATX tank cars



## GENERAL AMERICAN TRANSPORTATION CORPORATION

135 South La Salle Street . Chicago 90, Illinois

District Offices: Buffalo • Cleveland • Dallas • Houston • Los Angeles • New Orleans
New York • Pittsburgh • St. Louis • San Francisco • Seattle • Tulsa • Washington
Export Dept.: 10 East 49th Street, New York 17, New York

So many people have requested reprints of these cartoon advertisements that we are making them available to you for use in your shops. Just write us.



#### Temperature Controller Use Resistance Bulb

A newly designed temperature controller is said to accurately control operating temperatures ranging from -100 deg. to +600 deg. F. Resistance bulbs sensitive within 0.1 deg. F. actuate the controlling mechanism.

Single or duplex control action are provided in any of six different temperature ranges. A relay with load contacts can operate heating elements, motor starters, electric valves, and signal contacts for the red and green lights on the instrument door.—Servo Electric Co., Inc., Fairlawn, N. J.

#### Strip Recorder Has 30-Day Chart

The Model 53 Consotrol recorder features a 4-in. wide 30-day strip chart having the same scale length and high readability as the conventional 12-in. circular chart. This unit is a receiving instrument equipped with a micrometer control point setting device, automatic manual transfer switch, and an indicating scale to show control point setting and valve motor pressure.

Chart visibility allows viewing almost six hours of chart record without opening the instrument door. Reference back to the rewound record is easily accomplished by an unwinding thumb wheel.

This instrument is designed for use with any standard (3-15 psi.) pneumatic measurement transmitter and any standard pneumatically set receiver-controller. Inside the instrument there are three matched 3-15 psi. elements. One receiver element responds to the transmitter measurement and positions the recording pen.

The second receiver element positions an indicating pointer on a 3-15 psi. scale to show valve motor pressure. The third element is a precision transmitter unit. Output pressure from this unit is determined by the position of the manually set lever on the 0-100 set point indicating scale. This unit supplies set point pressure for automatic operation and valve motor pressure for manual operation.

All connections are 4-in female N.P.T., including 20 psi air supply for the set point transmitter. A 4-in electrical conduit connection is also provided. All connections are readily accessible at the back of the instrument and are clearly identified.—The Foxboro Co., Foxboro, Mass.



#### Industrial Viscosimeter Will Not Foul Up

A new viscosity measuring instrument is particularly suitable for process control applications where solutions tend to solidify when exposed to air. Continuous submersion of the element below liquid surface overcomes this difficulty.

Measuring element consists of a perforated hollow rod enclosing a piston assembly. The perforated part of rod is located below liquid surface. A motor cam mechanism at top of rod raises piston, drawing a sample of solution into space within the cylinder below the piston. Piston is then released and viscosity is measured as a function of the time required for piston to drop and expel liquid.

Measurements are carried out and recorded automatically and continuously.—Norcross Corp., 247 Newtonville Ave., Newton 58, Mass.



#### Automatic Tank Gage Measures Liquid Level

This automatic liquid-level gage is designed for use on low-pressure storage tanks up to 70 ft. in height. A full view direct reading counter gives quick, accurate reading of foot increments. An adjacent dial reads in inches and fractions of tank content. A patented motor housed with gage head maintains a predetermined constant tape tension, thereby climinating the need for conventional counterweight.

Box holding counter and dials may be installed at any desired height from ground. A gravity compensator incorporated with inch reading dial permits adjustment to compensate for a liquid gravity change.—The Vapor Recovery Systems Co., Compton, Calif.

## Increased Sensitivity For Spectrophotometer

A new photomultiplier attachment greatly increases sensitivity of the Beckman Model DU spectrophotometer. With this new attachment it is now possible to obtain an overall amplification gain from one hundred to one thousand times that of the standard ultra-violet sensitive photo tube. Resolution is greatly increased in all spectrophotometric measurements. This is particularly true in flame, fluorescence and turbidimetric determinations.

Installation of the photomultiplier attachment is simple and no instrument modification is necessary. The attachment consists of an auxiliary battery box and a specially arranged phototube housing.—Beckman Instruments, Inc., South Pasadena, Calif.

# FOR SAFER CONTROL OF CHEMICAL FLUIDS

## USE THESE **CRANE**HEAVY DUTY ALL-IRON VALVES

Crane Ferrosteel valves—recommended especially for ammonia service—are also ideal for process piping that requires heavy duty valves of all-iron and steel materials. Special Crane seating design and rugged construction combine to make these valves highly effective for safe and economical handling of hazardous or noxious liquids and gases. They minimize the danger of costly fluid losses with important features like these:

TIGHT SEATING—two disc-seat combinations available: (1) special lead-faced disc and integral body seat rings; (2) steel disc and renewable steel seat rings.

EXTRA-TIGHT STEM SEAL—Unusually deep stuffing box is filled with high grade packing. Machined "back seating" shoulder on stem relieves internal pressure on packing, further assuring a pressure-tight stem seal when valve is wide open.

RUGGED CONSTRUCTION—Heavy, massive metal sections in body help resist distortion; long sweeping interior body contours reduce flow resistance.

LEAKPROOF END CONNECTIONS—Flanged valves have tongue and groove faces for greater tightness and to protect against gasket blowouts. Screwed valves have long threads with a recess for soldering joints.

companion lines of check valves, fittings and specialties of equally outstanding Crane design are available. Fully described in your Crane No. 49 Catalog. Or see them in Crane Circular 320 on Corrosion-Resistant piping materials—your copy supplied on request by your Crane Representative.

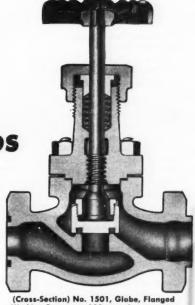


CRANE CO., 836 S. Michigan Ave., Chicago 5, Ill. Branches and Wholesalers Serving All Industrial Areas

EVERYTHING FOR EVERY PIPING SYSTEM

CRANE

VALVES . FITTINGS . PIPE . PLUMBING AND HEATING



(Cross-Section) No. 1501, Globe, Flanged Working Pressures: 300 pounds ammonia; 500 pounds oil, gas, or air up to 100° F. Sizes: ½ to 4-inch. Tested at 300 pounds Air-under-Water

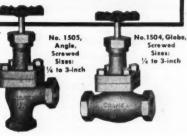
## CHOICE OF TWO TIGHT-SEATING DESIGNS

Crane special leadfaced disc—with facing securely rolled into machined dovetail—seats against crowned face of integral body seat to assure tightness in service. Where temperature or corrosive action does not allow use of lead, these valves can be sup-



Cross-section of

plied with a case-hardened steel disc and steel seat ring.



#### Recording Potentiometer Has New Features

A new null-balancing recorder has been designed for increased simplicity of mechanical and electrical construction.

A simplified chart frame swings out full 180 deg., permitting chart installation in about half the usual time. During this operation the chart always remains in time sequence. When the frame is opened the recording pen lifts automatically.

A simple and quick screwdriver adjustment provides selection of five different chart speeds. These speeds may be doubled or quadrupled by simply changing one worm and gear assembly.

Ranges are changed merely by substituting the desired range standard on the range panel and tightening by screwdriver. There are no soldered connections to break and no changes are necessary in the universal slide wire. Pen design has been modified to reduce lint pickup, blotching and tearing of chart at slow speeds.

Amplifier tubes are of a common type that require no matching and are available at radio supply stores. Removal of the amplifier assembly requires merely pulling the plugs and removing two holding screws.—Weston Electrical Instrument Corp., 617 Frelinghuysen Ave., Newark 5, N. J.



### Static Detector Has Variable Sensitivity

A new highly sensitive static detector is now available for use with the Keithley vacuum tube electrometer. This device, Model 2005 static detector, provides a convenient means for detecting and locating static charges. It is said that the detector can be used for locating charged

bobbins in textile mills, detecting charges on moving paper or plastic sheeting in printing and chemical plants, and for sensing dangerous charges in explosives plants.

The detector consists primarily of two concentric tubes and an aluminum rod. Results obtained with this device are qualitative and observed by noting the deflection of the meter pointer. Sensitivity can be varied over a wide range by raising or lowering the inner tube. As an example of the sensitivity, with the inner tube lowered a charged pocket comb 10 ft. away will throw the pointer off scale.—Keithley Instruments, Dept. 206. 3868 Carnegie Av., Cleveland 15, Ohio.

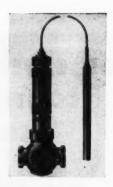


## Instrument Calibrator Is Portable

Calibration and testing of low pressure instruments and controls is made easier and more accurate by this low-pressure portable calibrator. Used for years in calibrating instruments on a factory production line, this instrument is now available in portable form. In many cases it makes possible the calibration of instruments without removing them from mountings.

The unit is particularly adapted to calibration of flowmeters, draft gages and differential pressure transmitters with ranges from 0 to 20 in. of water—pressure, vacuum or compound. Accuracy is within 0.01 in.

Calibrator consists of a standard chemical weigh scale and an oil sealed bell. Weights on the scale are balanced against an opposing air pressure in the bell. Thus, bell air pressure can be determined with laboratory scale accuracy and used as a standard for the calibration of an instrument.—Republic Flow Meters Co., 2240 Diversey Parkway, Chicago 47, III.



#### Temperature Regulator Operates Hydraulically

Series V, a new line of self-operated temperature regulators, utilizes liquid expansion with rising temperature. As the liquid medium expands or contracts with temperature changes, its movement is directed against the control valve to hold temperature within the desired range.

This unit is available in sizes ranging from 4 in. to 4 in. for controlling temperatures between 25 and 275 deg. F. Inlet pressure and temperature limits are 125 psi. and 450 deg. F. Valves are constructed with bronze bodies and renewable bronze or stainless steel seats and disks. The bulb standard and connecting capillary tubes are nickel-plated brass and nickel-plated copper, respectively.

This device can be employed to control the flow of steam and any liquids or gases that are not corrosive to brass.—Farris Stacon Corp., 501 Commercial Ave., Palisades Park, N. J.

#### Water Vapor Indicator Measures Gas Moisture

The recently improved Aminco-Weaver water vapor indicator measures water vapor content of compressed gases. Effective operation range is from saturation down to 0.003 mg. per liter or less. Accuracy obtainable is within 10 percent of the amount of water present. Measurements are reproducible to 0.002 mg. of water per liter.

Originally developed for acceptance tests of aviators' breathing oxygen, this device is now finding industrial application. Among its uses are the determination of refrigerant dryness; the study of water evolution resulting from chemical or physical changes;

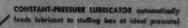
## EASIEST MAINTENANCE EVER!

## NEW Lightnin Mixers...

For low-cost blending-mixing-agitating in tanks up to 5 million gallons

NEW RIGHT-ANGLE DRIVE

NEW HIGH-SPEED STUFFING



CHOICE OF STUFFING BOXES (or



GUARANTEED TO DO THE JOB-AND DO IT RIGHT-OR YOUR MONEY BACK!

for every fluid mixing job

EVERY LIGHTNIN MIXER IS GUARANTEED TO DO THE JOB PORTABLE SIDE ENTERING TOP ENTERING

1 to 25 HP

14 to 3 HP

FOR PARTICULARS, call your MIXCO representative, or write us today.

## MIXING EQUIPMENT Co., Inc.

128 Mt. Read Blvd., Rochester 11, N. Y.

In Canada: William & J. G. Greey, Ltd., Tereste Please send me the bulletins checked:

- ☐ 8-102 Top Entering Mixers ☐ 8-100 Condensed (turbine and paddle types) ☐ (complete line) ☐ Cetalog
- □ B-103 Top Entering Mixers □ B-75 Portable Mixers (propeller type) (electric and air driven) ☐ B-104 Side Entering Mixers ☐ DH-50 Laboratory Mixers



## SPARKLER FILTERS

flexibility that permits use of all types

of media; and many other distinctive

If quality and efficiency at econom-

ical operating costs are your foremost

considerations, you will want to know more about Sparkler filters.

Write for your copy of the Sparkler catalog today. For engineering assistance, write Mr. Eric Anderson.

Each company whose trade-mark is shown above has, for many years, produced medicinals meeting the highest attainable standards. As a result, their reputations are based on what amounts to a public trust that products bearing these trade-marks can be used with complete confidence. To protect their positions of leadership, these manufacturers employ every conceivable safeguard to assure unvarying purity.

We are proud, therefore, that Sparkler filters have been chosen by such outstanding companies, and that we have been associated with them for so long — because we earnestly believe that Sparkler filters have contributed to their success.

Sparkler design and construction lend themselves perfectly to sanitation and superior filtration because Sparkler originated and perfected the horizontal plate principle; the scavenger plate to assure complete recovery of product; the use of cartridge-type elements that minimize down-time and simplify cleaning; the

Representatives in all principal cities

Chemical Show Boothers 109 & 110

SPARKLER MANUFACTURING COMPANY Mondatein, Illin

Equipment News, cont. . .

the determination of water vapor content in gas manufacture, process control and laboratory research and testing

Measurement depends on the change in electrical resistance of a hygroscopic film with changes in the moisture vapor content of the gas being measured. Testing procedure involves establishing the film resistance for a standard gas such as air or oxygen when saturated with a known amount of water vapor. The gas sample being tested for water vapor content is then contacted with the hygroscopic film. Gas pressure is adjusted to give the same resistance reading as the standard gas. A simple calculation with a slide rule type calculator gives the water vapor content of sample tested .-American Instrument Co., Inc., Silver Spring, Md.



#### Photoelectric Cell Sorts According to Color

The new Gromax electronic colorsorting machines grades materials such as almonds, peanuts, cottonseed, sugarcoated pills and catalyst pellets to produce a uniform high-quality product. Sorting of these materials is based on color variation between standard and off-standard particles. Photoelectric cells detecting these differences actuate rejection of off-color material.

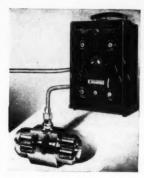
Use of the Gromax unit is said to produce nearly 100 percent efficiency in the sorting operation, while eliminating costly hand labor which is less efficient and subject to error.

The material enters the machine at the top of the cabinet and discharges through either of two openings located at the bottom. As it passes down into the machine, three photocells scan the single stream of individual particles, thereby assuring that there are no unscanned dead

spots. Low-voltage bulbs illuminating the material are positioned in such a manner that no direct light can fall

upon the photocells.

Two sizes of machines are available. Size A, which is 5 ft. high, 14 in. wide and 22 in. deep, can sort upwards of 30 to 40 lb. per hr., dependent upon the size and nature of the product being handled. This unit delivered costs approximately \$1,300. The larger type B machine, suitable for grading a minimum of 60 to 90 lb. per hr., is 6 ft. 2 in. high, 2 ft. wide and 1 ft. 7 in. in depth. The delivered price for this unit will be approximately \$2,000.—Newman's Inc., P. O. Box 1865, Tulsa, Okla.



## Fluid Flow Is Measured Electrically

Here is a novel hydroelectric installation which is actually a device for measuring flow rate. The Potter-Brown flowmeter consists essentially of three parts: a sensing element installed in the flow stream which produces an ac output whose frequency is directly proportional to the rate of flow; a converter which delivers and c voltage output proportional to the frequency of the ac produced by the sensing element; an ElectroniK potentiometer which measures the dc output of the converter and indicates and records it as flow.

The sensing element which mounts directly in the flow line contains a rotor which spins at a rate proportional to the velocity of flow through the unit. This rotor contains an internally mounted permanent magnet which sets up an ac voltage in a pickup coil externally mounted on the sensing element. The frequency of this induced voltage varies directly with the rotor speed.

The Potter-Brown flowmeter is said to be capable of handling toxic or



Few other industries require the painstaking supervision, accuracy, or sanitation that is necessary in the production of drugs used to perform "everyday miracles." Yet in spite of this, each of the companies whose trade mark is shown above, day after day, year after year, produces pharmaceuticals that never meet anything less than the highest standards of purity.

Of course, the plants operated by these companies are models of precision, planned to achieve the greatest possible efficiency with the finest equipment available. That's why, in each of these plants, you will find Sparkler filters handling difficult liquid filtration jobs.

It is important to remember that Sparkler filters were designed with the same goals in mind—accuracy and sanitation—that are accepted as a fundamental part of the drug industry. They utilize the patented Sparkler horizontal plate principle to provide firm support for the filter media and filter aid. This horizontal surface permits the formation of a stronger, completely uniform cake that will not slip or crack even under intermittent operation. Thus, filtration quality through the entire cake is constant, and can easily be regulated by varying the cake density.

Plates are assembled one above the other and are fastened together in car-

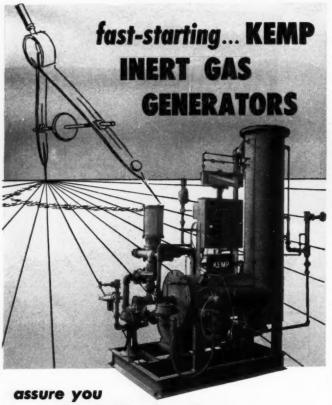
tridge form, making it extremely simple to remove them from the filter for cleaning. Other Sparkler features include compact, neat design, high flow rates and low operating cost

and low operating cost.

For full information, write to Mr.

Eric Anderson. New catalog is available





chemically clean inert
gas at a specific analysis

PERFORMANCE reports from Kemp users throughout the chemical field show: Kemp Inert Gas Generators produce and maintain a specific analysis of chemically clean inert gas regardless of demand. Eliminate the possibility of mixture fluctuations at some critical phase of processing... offer the best selection of versatile, flexible designs. And in addition, each Kemp Generator is engineered for fast-starting, easy operation so as to save you both time and money spent on the warm-up periods.

You can't go wrong when you specify Kemp.

Set it ... forget it!

The Kemp Industrial Carburetor, standard equipment and the very heart of every Kemp installation, assures you complete combustion . . . without tinkering . . . without waste. Uses ordinary gas right from mains. Every Kemp Design includes complete up-to-the-minute fire checks and safety devices. Why not find out how Kemp can help you with your problems, today?

KEMP

INERT GAS GENERATORS

Write for Bulletin I-10 for technical information THE C. M. KEMP MFG. CO. 405 E. Oliver St., Baltimore 2, Md.

DESCRIPTION - BURNES - PRE CAPONS - ATMOSPHESS & ROST CAS GENERATORS DESCRIPTION - METAL MINISTERS UNITS - SERCING COMPAGNS - SPECIAL COMPAGNS

EQUIPMENT NEWS, cont. . .

highly corrosive substances, viscous liquids or other fluids under pressures up to 20,000 psi. and temperatures ranging from minus 269 deg. C. to 1200 deg. F. The elements are sized to measure flows up to 4,000 gpm.—Minneapolis-Honeywell Regulator Co., Industrial Div., Minneapolis 8, Minn.



#### Industrial Refractometer Gives Fast Results

Fast refractometer determinations are now possible, using a new high-speed industrial refractometer. Designed for production line use in the food, dairy products, pharmaceuticals, petroleum and plastics industries, this instrument gives an analysis in 10 to 15 sec. Accuracy to  $\pm 0.001$  can be obtained.

Any one of seven specific ranges can be built into the instrument according to the user's specifications. Depending on the scale selected, the instrument will give readings in terms of refractive index, percentage of dissolved solids or Butyro number.

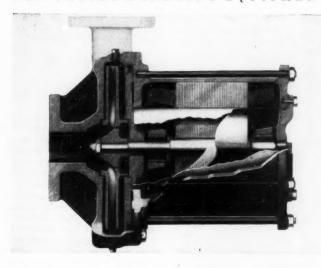
To use instrument, operator simply places a normal amount of specimen on top-loading horizontal prism and looks into a single eye piece. A built-in color compensator gives an extremely sharp dividing line on the fixed eyepiece scale.

When prism box is opened both prisms lie horizontally and in position for quick, easy cleaning. Prisms are set in a special cement that is impervious to attack by food acids and has a hard, easily-cleaned surface.

A spiral flow temperature control chamber allows stable heating of prism assembly with maintenance of temperatures up to 100 deg. C.

Complete with hardwood carrying case, the instrument is priced at \$490.

—Bausch & Lomb Optical Co., Scientific Instrument Div., Rochester, N. Y.



## New Pump Design Stops Leakage

Motor and pump are combined in one assembly. Nonmagnetic sleeve in motor air gap seals stator from liquid which circulates freely over rotor and through bearings.

The industrial need for a leakproof centrifugal pump has been growing more acute so that pump manufacturers are responding with radical new leakproof pump designs. The latest of these is the Chempump pictured in the cutaway drawing above.

The pump side of the unit incorporates standard centrifugal pump design features. However, the method of coupling motor and pump together and sealing against leakage to the atmosphere is completely new and novel.

In so far as the motor stator and rotor are concerned, they are essentially the same as those in a standard squirrel-cage motor. However, here the comparison ends since a portion of the fluid being pumped circulates through the motor. The reasons for this are several. First, in order to eliminate the conventional stuffing box with accompanying leakage it is mandatory that the prime mover be scaled inside the liquid system. From this it follows that bearing lubrication and motor heat dissipation must come through circulation of the liquid being pumped.

In order to achieve this successfully, the windings of the motor stator had to be isolated from the liquid to avoid short-circuiting the windings. This was accomplished by insertion of a non-magnetic sleeve into the motor air gap, effectively isolating the stator winding from the liquid. Motor rotor and pump impeller are mounted on a common shaft supported by two graphite composition sleeve bearings. Thrust washers mounted against the rotor ends permit the pumps to be mounted in any position.

Perfect bearing alignment is secured by having the bearing supports, which are in the end covers, bored concentric with the shoulder which seats against the inside surface of the nonmagnetic stator seal. In turn, the individual bearings have the inside diameters honed and the outside diameters honed and the outside diameters borned and the outside diameters ground to perfect concentricity. These bearings, installed in the bearing supports, provide the required rotor impeller alignment. Bearings and bearing supports go together with a slip fit, permitting easy replacement. Lubrication of the bearings is provided for by a small bleed pipe connecting the high pressure side of the pump casing with the outboard end of the motor. Fluid entering the motor casing at this point circulates in around the bearing on the outboard end, through the air gap between rotor and stator, through the inboard bearing and into the pump impeller eye.

If an abrasive slurry is being pumped, it is only necessary to provide a small amount of the slurry liquid phase as a lubricant for injection into the outboard end of the motor. Volume-wise, this quantity is so small that the slurry proportions will not be altered appreciably. And with flow always moving toward the low pressure region at the impeller eye there is said to be no danger of slurry solids working back into the bearings.

A number of definite advantages are claimed for the Chempump. Among these are freedom from bearing alignment and lubrication problems, elimination of rotary shaft seals and accompanying leakage problems, elimination of liquid losses, reduction in spare parts required as well as process down time and maintenance labor. Chempumps can be mounted in the fluid line in the same manner as a valve without requiring a separate supporting base.

Advantages claimed for these pumps are said to rest not only on the performance of the present pump but also on experience gained in the production of a similar \(\frac{1}{2}\) hp. unit. A total of 20,000 of these pumps have been operating satisfactorily since 1947.

On Aug. 15, 1952, these pumps will be available in 1-, 2- and 3-hp. sizes with cast iron construction. After Sept. 15, 1952, the same sizes may be obtained with type 316 stainless steel construction. Now in the design stage are 5, 7.5 and 10-hp sizes.—Chempump Corp., 1300 East Mermaid Lane, Philadelphia 18, Pa.

#### Eighteen Types of Hose Are Consolidated to Five

Five basic types of molded rubber hose, color coded for identification, now replace 18 former types produced by Thermoid Co. This consolidation offers fully as much versatility as formerly, it is said, due to improved performance gained by use of new

components. Reduction in the number of hose types provides substantial savings in inventory handling and

storage costs.

Versaflex hose, identified by its red cover, is constructed of multiple braids of high tensile rayon yarn and special synthetic oil resistant tubes and covers. This construction enables hose to handle materials such as propane, butane, insecticides and oil-base sprays up to 800 psi.

Versicon with a brown cover will serve nearly all industrial uses at working pressures up to 300 psi. High tensile rayon braids provide for long life under high pressures handling compressed air, acetylene, water, greases, oil, gasoline and many other

materials.

Aquair with a green cover is designed principally for conducting water, air, oxygen and acetylene at working pressures up to 200 psi.

Utility is a general purpose hose for working pressures up to 125 psi. Identified by a black cover this hose is designed chiefly for water and air.

Powerflex steam hose is specifically designed for superheated steam up to 200 psi. Hose body has a combination of steel wire braids and asbestos braided yarn.—Thermoid Co., Trenton, N. J.



**Double-Suction Pump** Has Mechanical Scals

Double mechanical shaft seals with pre-lubricated ball bearings have been incorporated in Ingersoll-Rand's line of small single-stage, double-suction pumps. Use of a double shaft seal provides more efficient sealing and prevents air leaking into the pump when it is operating under suction lift. Pressure injection of external sealing liquid into the seal box gives the double seal a long service life under conditions where the pump is handling grifty and abrasive slurries.

A shorter, more rigid impeller shaft

is possible through the use of mechanical seals. A shrink fit is used in attaching the impeller to the shaft. The absence of threads, reductions or slots in the unsupported shaft length eliminates the possibility for stress concentration.

These DMV-DHV pumps are built in 3, 4, 5 and 6 in. sizes for services up to 200 deg. F. Top capacity is 2,100 gpm. at 150 psi. Manufactured with cast iron casings, carbon steel shafts and bronze impellers, they are suitable for any non-corrosive service.—Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.



Centrifugal Fan Has Air Foil Blade

Use of air foil blade design in a new type centrifugal fan has boosted efficiency to over 90 percent with a two-third decrease in noise intensity. Higher initial cost is said to be counterbalanced by lower operating cost.

Available sizes range from 404 in. to 1084 in. fan diameter. Air pumping capacity ranges up to 600,000 cfm.—Westinghouse Electric Corp., Sturtevant Div., Hyde Park, Boston 36, Mass.

#### Turbine Vane Pump Delivers Constant Flow

Recently introduced by Peerless Pump is a complete line of selfpriming and standard design turbine vane-type pumps. Hot or cold clear liquids, with or without vapor, can be pumped in moderate capacities against medium or high heads. The turbine vane design will deliver a constant discharge rate under varying head conditions.

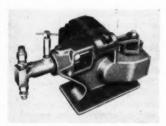
In the turbine vane-type pump liquid enters suction inlet, passes through suction ports and is picked up by a single multi-vaned impeller. The rotating vanes throw liquid by centrifugal force into a channel which deflects it into succeeding vanes on impeller. This process repeats as liquid travels around channel continually building up pressure until stop is reached which deflects liquid into discharge outlet.

No suspended solids can be tolerated, otherwise the close-running clearance of impeller, required for optimum operation, is destroyed.

Pumps are constructed with cast iron case, bronze impeller and liners, stainless steel shaft, and standard mechanical shaft seals. Cover liner, impeller and inner liner are all replaceable.

Type TVE pumps are designed for close-coupled face mountings on the drive motor. Type TVB is furnished for flexible coupling to an electric motor mounted on a common bed plate.

Pump handles 58 gpm. up to 800 ft. head at 3,500 rpm., and capacity at 1,750 rpm. is 56 gpm. up to 300 ft. head. Motor sizes up to 20 hp. are available at 3,450 rpm. and up to 7½ hp. at 1750 rpm.—Peerless Pump Div., 301 W. Ave. 26, Los Angeles 31. Calif.



Compact Metering Pump Meets Low Capacity Needs

Accurate feeding of chemical solutions at low rates against medium pressures is the function of Model X-52 Adjust-O-Feeder. Motor, gear box and pump are all mounted on a one-piece Mechanite iron frame, thus assuring positive alignment of all moving parts.

This pump has an adjustable capacity range of from 1 to 10 gph discharging against pressures up to 650 psi-ga. Where required a feeding range of 0.5 to 5 gph. can be provided. Total unit weight is less than 100 lb.—Proportioneers, Inc., 345 Harris Ave., Providence 1, R. I.



#### Centrifugal Compressor Boosts High Pressure Gas

A new centrifugal compressor handles gases in high-pressure systems operating above 600 psi. at flows as low as 125 cfm. Design lends itself to pressure differentials up to 50 psi. using a direct-connected conventional electric motor.

Gases having a high contamination of abrasive solids are satisfactorily handled by this unit. A built-in lubrication system ensures an oil-free flow of gas since impeller requires no lubrication. In over-all dimensions these compressors are considerably smaller than reciprocating compressors of corresponding capacity.

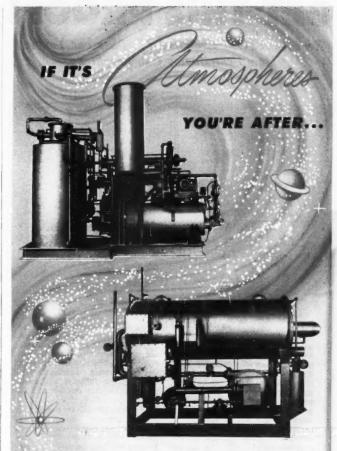
Use of this compressor is recommended on all types of gas recycling operations in the chemical and petroleum industries. In particular, it is adapted to fluidizing powdered or granular materials for accurate feeding in high-pressure systems.—Sawyer-Bailey Corp., Buffalo, N. Y.

#### Modified Flow Regulator Provides Greater Accuracy

The Kates direct-acting flow rate regulator has recently been modified to provide greater accuracy and improved performance. Designed for use wherever liquids are handled, this regulator is widely adaptable for accurate control of flow rate.

Operation is simple and troublefree. You merely set calibrated dial to desired flow rate and regulator automatically holds flow to set rate despite pressure fluctuations in either inlet or outlet lines. Action of regulator is quick and positive without hunting or time lag.

Standard capacities range from 0.1 to 100 gpm. of water giving accuracy within 3 percent. For special applications, larger capacities and greater accuracy can be furnished.—W. A. Kates Co., 430 Waukegan Rd., Deerfield, Ill.



Here are two great new generators that really do the work . . .

Gas Atmospheres has come up with two new atmosphere generators — a Nitrogen and an Inert — completely packaged units that are unsurpassed by

anything in the field. Compact — these generators require less floor space per foot of gas than any generator made. Foolproof — they incorporate the latest approved safety devices . . . can be installed either inside or outside. Production — quality, uniform analysis atmospheres at constant out-put regardless of fluctuating supply gas. Automatic — push button control, easily accessible panel includes all controls.

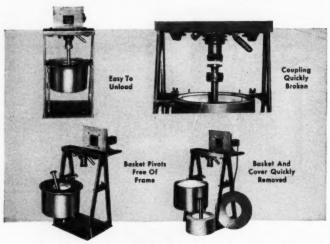
Many other extras make these generators the finest available today. Before you buy generator equipment be sure to talk with a Gas Atmospheres engineer... it will pay off in the most efficient, inexpensive, trouble-free atmosphere production you've ever had.

For more complete information write for Bulletin number I-552



## **GET THIS PROOF!**

Rent An AT&M Centrifugal . . . See For Yourself How Centrifuging Can Benefit You



Are you missing the advantages of centrifuging? Do you know that in many instances AT&M equipment does away with settling tanks, filter presses, squeeze rolls, vacuum presses? That it is saving time, space and costs in processes involving chemical preparations—explosives—nitrating—acid wringing—ammonium sulphate—food products—soap—drugs, medicines, cosmetics—oils and greases—paints, varnishes—ceramics, brick, clay—fertilizers—nitrates—sludges—textiles—plastic bases?

Here's an easy, inexpensive way to prove to yourself exactly what centrifuging can do for you. Rent an AT&M laboratory model centrifugal. Then you can test your own materials and check the results. Ideal for laboratory or pilot plant operation, these machines develop centrifugal force comparable to full size equipment, providing you with accurate data for full scale production.

AT&M centrifugals are packed with AT&M-engineered design developments—for example: variable speed drive; perforate or imperforate baskets, rubber covered or in any machinable metal; fume-tight hoods for processing volatile liquids.

#### RENTALS COST LITTLE

You can rent a laboratory centrifugal from AT&M at a very nominal rate. If you later decide to buy, part of the rental fee will be credited against the purchase price. Write for particulars.

AMERICAN TOOL AND MACHINE COMPANY 1415 Hyde Park Avenue, Boston 36, Mass.  Illustrated Booklet
Please send me my free copy of the new AT&M booklet "Centrifugal Force." I am interested in the following processes:
Separation
NameTifle
Company
Street
CityZoneState
SAVE TIME, A.T. and M. COSTS WITH CENTRIFUGING

EQUIPMENT News, cont. . .



#### Heated Valves Overcome Frost Problems

Freedom from frost and ice in liquid carbon dioxide service at temperatures as low as -110 deg. F. can now be obtained with a new electrically heated valve, according to a recent announcement.

You can see in the above picture that the heating elements are mounted right in the line on studs protruding from the main valve body. In this manner heat from the elements is transmitted directly to the valve seat. As a result the entire flow opening through the valve and the operating mechanism is adequately heated.

Heated valves in sizes from 2 in. to 6 in. are available with pneumatic, hydraulic, solenoid or manual control. Heating elements can be provided for 110- or 220-v. operation with inputs from 400 to 3,000 w. per unit.

The manufacturer's line of standard valves may be converted merely by installing extra-length studs. For hazardous atmospheres a modified design will soon be offered.—Okadee Co., 332 S. Michigan Ave., Chicago 4, Ill.



## Pipe Coupling Eliminates Pipe Threads

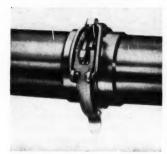
This new factory assembled pipe coupling can be installed in any piping system in less than sixty seconds. No pipe threading is required. Pipes to be connected are simply inserted into ends of Quik-Joint coupling body and

lock nuts wrenched to desired tightness.

Resultant tightly sealed flexible joint can withstand working pressures up to 2,000 psi.

Body of coupling is pressure tested pipe steel with a thicker wall than pipe being joined. Lock nuts and gasket retainers are drawn from cold rolled steel. Rubber compression gasket comes in a number of formulae, depending upon desired application.

It is said cost per joint is only a fraction of cost for threaded joints using cast or forged bodies. Quik-Joint is available in sizes from ½ in. to 1½ in. IPS as straight coupling, 90-deg. and 45-deg. ells. Welded and threaded adapters are also furnished. —Quik-Joint Mfg. Co., 469 E. 159th St., Harvey, III.



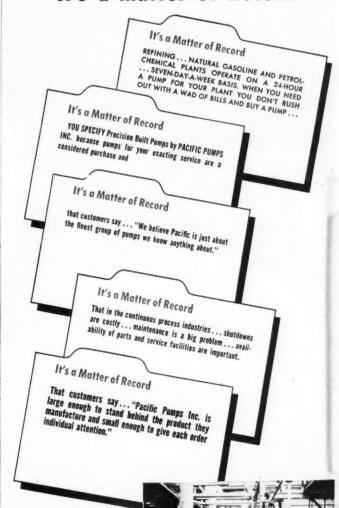
#### Spring Clamp Joins Sanitary Fittings

The new Tri-Clamp threadless sanitary fitting offers great speed and ease of installation together with appreciable savings in original investment cost and longer trouble-free fitting life, it is said.

The Tri-Clamp joint consists of flange type ferrules mounted on the tubing ends of the joint, each of which has an annular grove in its mating face. A special precision molded Hycar gasket fits into the groove when the two ferrules are brought together. A special fabricated spring clamp actuated by a simple snap action toggle fits the ferrule edges, maintaining a tight seal.

Field and laboratory tests are said to have shown these fittings truly sanitary and one hundred percent leak-free. Lines requiring disassembly for cleaning may be instantly taken down by opening the snap action clamp.—
Tri-Clover Machine Co., Kenosha, Wis.

## It's a Matter of Record



#### It's a Matter of Record

The excellent performance of the two stream-burbine driven four-stage pumps installed in 1939 to pump light hydrocarbons of .465 sp. gr. operating at 3400 R.P.M. In 1942 the speed was increased to 3900 R.P.M. From 1939 to 1950—time on stream 82+%...pump parts refinished 0...pump parts replaced 0. Third unit installed in 1947 to operate at 4000-4200 R.P.M.





## Pacific Pumps inc.

HUNTINGTON PARK, CALIFORNIA Export Office: Chanin Bldg., 122 E. 42nd St., New York Offices in All Principal Cities

## IF YOU USE SHEET ALLOY EQUIPMENT IN ANY OF THESE 30 CLASSIFICATIONS Size 81/2"x11" to fit standard file Sign . Tear Out . Mail The Pressed Steel Company 707 N. Penna. Ave., Wilkes-Barre, Pa. Send us a copy of your catalog on welded alloy equipment for heat-treating, oil refining, and processing of chemicals, drugs, foods, etc.

INDUSTRIAL EQUIPMENT OF HEAT AND CORROSION-RESISTANT SHEET ALLOYS

You will find the new PSC CATALOG

> CLASSIFICATIONS OF PSC HEAT AND CORROSION-RESISTANT INDUSTRIAL EQUIPMENT

Baskets, annealing & carburizing Baskets, cyanide dipping Baskets, pickling Bends, alloy pipe & tubing (welding) Boxes, annealing & carburizing Caps, bubble (fractionating tower & still) Caps, cylinder (compressed aus) Covers, annealing (Bell furnace) Covers, annealing (elevator furnace) Fixtures, carburizing Flights, conveyor (syn. rubber plant) Headers, air pre-heating Manifolds, gas exhaust Muffles, carburizing Piping, process (alloy only) Pots, carburizing & annealing Pots: lead, cyanide & salt Racks, annealing & carburizing Racks, sheet pickling Retorts, carburizing Rings, neck (compressed gas cylinder) Tanks, copper annealing Tanks, pickling Trays, annealing & brazing Tubes, annealing Tubes, furnace vent Tubes, radiant furnace Tubes, thermocouple protection Tubing, corrosion & heat resistant

Company

Address

**Tubing Assemblies, welded alloy** 

### New Rubber Hose Resists Strong Acid

A new rubber hose compound now permits handling stronger acid concentrations than heretofore possible. Good resistance to one hundred percent acid is claimed, except for nitric and sulphuric, whose top limits will be 75 percent and 98 percent, respectively.

The resistance of this hose to all acids and alkalies is being evaluated. Suitable performance is obtained in handling chlorine and saturated chlorine water.—Hewitt-Robins, Inc., 666 Glenbrook Rd., Stamford, Conn.



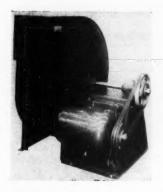
Downflow Purifier Cleans Steam, Vapor

Here is another of the Hi-eF purifiers. This internal downflow purifier mounted above process vessels cleans entering vapor removing dirt, moisture, riser discharge and solids.

Unit carries a guarantee to the boiler industry to deliver vapor with 1.0 ppm. or less of total solids. On other applications the purifier is guaranteed to remove 99 percent of all entrainment.

Foreign matter is removed by a multi-stage centrifugal element which engages the entrainment vapor entering purifier. Cleaned vapor or steam passes through outlet, while foreign matter is discharged to a drain. It is said that there is no critical pressure drop through unit.

Constructed of fabricated steel, stainless steel or other alloy materials, unit can be furnished with outlet sizes from 4 in. to 24 in. with slip joint connections. Threaded outlets are available in sizes from 4 through 10 in.—The V. D. Anderson Co., 1935 W. 96th St., Cleveland 2, Ohio.



Industrial Fan Moves Air and Solids

A new rugged industrial fan is furnished either with an air-handling, materials-handling, or a long shavings wheel. This fan is made in eleven sizes with capacities ranging from 670 to 44,000 cfm. at pressures up to 16 in. of water gage.

The air-handling wheel has backwardly inclined blades, giving low power consumption over a wide range of volumes and pressures. The wheel used for conveying sawdust, granular materials and chips is a heavy-duty, straight-bladed, side-plated type. Where long, stringy fibers are to be conveyed, a wheel without side plate is used.—Westinghouse-Sturtevant Div., 200 Readville St., Hyde Park, Boston 36, Mass.



Diaphragm Valve Has Plastic Body

The familiar Saunders diaphragm valves are now being made with a polyethylene type body and rubber, neoprene or polyethylene diaphragm as required. These construction materials permit handling a wide variety of corrosive chemicals. Also these odorless, tasteless non-toxic materials are suitable for food handling.

Standard sizes threaded for standard pipe threads are available from ½ in. to 2 in. for working pressures up to 50 lb. per sq. in. at 77 deg. F.

Use of this type valve with recently announced Ace Parian and Saran plastic pipe and fittings permit erection of completely protected, corrosion resistant, plastic fluid systems.—American Hard Rubber Co., 93 Worth St., New York 13, N. Y.

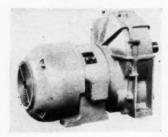




## PIPE COUPLING CLAMP SPEEDS TANKER UNLOADING

Use of this new coupling has decreased time for connecting tanker loading and discharge lines from 30 min. to approximately 2½ min. On the left you see the clamping assembly having two guide arms at the bottom of the flange and four equi-spaced clamps. Picture on right shows completed coupling clamped together.—Shell Petroleum Co., Ltd.

## NEW ELECTRICAL & MECHANICAL EQUIPMENT



#### Gear Motor Line Adds Larger Sizes

Rounding out its line of slow-speed electric power drives, the Sterling Electric Motors, Inc., has added larger, totally enclosed fan cooled gear motors. These new units are double reduction and are available with Class I, II and III gears in frame size 364/365, and AGMA speeds of 155 rpm. and slower in ratings from 5 to 25 hp.

Geared motors of this type are said to be well suited for low-speed drives where maximum protection is required against non-explosive liquids, dust or vapors.—Sterling Electric Motors, Inc., 5401 Anaheim-Telegraph Rd., Los Angeles 22, Calif.

#### Built-In Brake Motor Stons Instantly

Further modification has been made on the line of Graham transmissions by addition of a built-in brake motor available on transmission sizes from ½ to 3 hp. This feature permits immediate stops required in indexing and positioning work.

Advantages claimed for the directacting disk type brake are rugged design, fewer parts, smooth and instant action, cool operation and no solenoid or mechanical linkages. Braking pressure between pressure plate and disks is supplied by spring tension.

Electromagnet coils connected in parallel with the motor are energized when motor starts. This draws the pressure plate back against spring tension, releasing pressure on the disks. Stopping the motor de-energizes the coils, allowing spring compression to force pressure plate back against the disks, thereby stopping and holding the load.—Graham Transmissions, Inc., 3754 North Fulton St., Milwaukee 12, Wis.

## Protective Relay Is Accurate, Reliable

Now available for protection of transmission and distribution lines is the new Type CO protective relay. Described as a slow-speed over-current type with inverse or very inverse time characteristics, the relay is available in three ranges: 0.5 to 2.5 amp., 2 to 6 amp., or 4 to 12 amp.

Adjustable magnetic plugs in the newly designed electromagnet give accurate timing. Accurate pickup of tap value of current for all positions is provided by two independent adjustments. Metal-to-metal contacts between tap and terminal and tap and plate make the contact system of the new relay reliable.

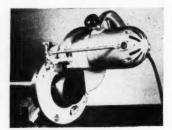
Other construction features include a one-piece die-cast frame and cast Alnico magnet.—Westinghouse Electric Corp., Box 2099, Pittsburgh 30,



## Air Transformer Regulates Air Pressure

This HLD air transformer has builtin two-stage regulating device which provides for easier adjustment of pressure, requiring only finger tip control of the adjusting knob. Movement of the knob actuates small pilot regulator. This in turn operates the diaphragm of the large regulator, thus giving ease of operation as well as closeness of pressure regulation and low pressure loss.

The unit has a capacity of 100 cfm and successfully removes entrained water and oil at this throughput. All parts of the device coming in direct contact with the compressed air are made of corrosion resisting metals.—
The De Vilbiss Co., 296 Phillips Ave., Toledo 1, Ohio.



### Power Cut-Off Saw Handles Pipe and Tubing

A new power cut-off saw is designed for quick, accurate cutting of pipe and tubing of aluminum, copper, stainless steel, etc., in varying wall thicknesses.

It has a free-moving rotating frame which surrounds the piece to be cut. The saw is attached to the frame so that both the frame and saw rotate together. All you do is set the saw to make the desired cut and then rotate it 360 deg. on the frame, cutting around the periphery of the tube or pipe until the cut is complete.

Cutting is done by a special heavyduty abrasive disk. The cut ends are smooth and square.

The saw comes in sizes ranging from 4-in. minimum, at \$250, to 12-in. maximum, at about \$400.—
Tri-Clover Machine Co., Kenosha, Wis.

### Explosion-Proof Fixtures Are Flush Mounted

A new 200-w. explosion-proof lighting fixture is designed for flush mounting in ceilings. The RCDE-8 fixture is available with an 8-in. lens providing symmetrical lighting distribution for general illumination. For special applications, requiring asymmetric distribution, a prismatic lens is readily furnished.

These fixtures meet a need where appearance is an important factor, where headroom is limited, or where surface or pendant mounted fixtures would be an obstruction to overhead equipment such as cranes and hoists. The prismatic lens fixture has been used successfully for the illumination of control boards and panel boards in petroleum refineries and chemical plants. Location of the fixtures in the ceiling adjacent to the panel boards allows direct illumination of the panels merely by positioning the prismatic lenses.-Crouse-Hinds Co., Syracuse 1, N. Y.



#### Bushing Extractor Saves Labor Time

Bushings, bearings, sleeves and liners may now be extracted in one-fourth the time formerly required by using the Crozier extractor. Surveys have shown that 53 percent of bushings set in blind holes are flush against the bottom, making it impossible to get behind them to use conventional pullers. The expanding arbor of the Crozier extractor grips the bushing on its inner surface, which makes it unnecessary to get a bite behind the bushing.

The Crozier extractor consists of eight threaded expanding arbors, a draw table with two sets of legs, short and long, which permit adjustment of the draw table height. The expanding arbors can handle any bushing from ½ to 2 in. I.D. A maximum of 2½ in. may be drawn at one setting, and press fits of over five tons have been extracted readily.—Crozier Machine Tool Co., 684 North Prairie Ave., Hawthorne, Calif.

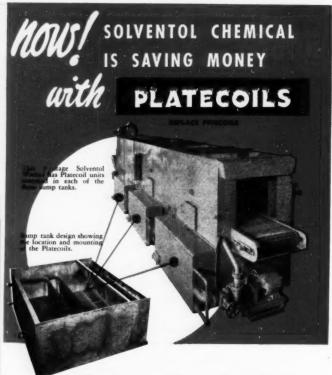
#### Safety Wiring Has Unusual Properties

Now available is a mineral-insulated safety wiring having unusual heat resistance, moisture resistance, mechanical strength and permanence. Wiring construction consists of solid copper conductors spaced and insulated by noncombustible magnesium oxide encased within a seamless copper sheath.

The completely mineral construction of the cable makes it entirely noncombustible. Complete moistureproofness is ensured by the seamless metallic sheath, and easily attached end terminations which completely seal against the entrance of moisture.

Safety MI wiring can withstand continuous exposure in ambient temperatures up to 250 deg. C. This





realizes 6 major advantages

Solventol Chemical Products, Inc., Detroit, Michigan has joined the growing list of manufactures who are saving money by using Platecoils in their products. Use of Platecoils as the heating medium in their 3-stage washer has resulted in 6 major advantages:

1. Simplified installation.

Sharply reduced installation costs, A higher rate of heat transfer.

Low first cost.

5. Solution flow controlled without baffles.
6. Increased sales advantages due to easier maintenance.

The Platecoils are installed in each of the three sump tanks as shown in the inset picture. The pre-fabricated Platecoil units are installed in but a fraction of the time required for bending and installing pipe coils. That's why most manufacturers find it costs less to buy and install Platecoils than to fabricate pipe coils

In addition, the Platecoils are about 50% more efficient than pipe coils. As a smaller size Platecoil can be used, considerable savings in steel and more compact machine designs are possible.

If you're looking for ways to conserve steel and save money, get the facts on Platecoil today. Write for bulletin P61.



EOUIPMENT NEWS, cont. . .

characteristic makes it admirably adapted for installation in extremely hot locations such as boiler rooms.

For general use with standard terminations, the current rating is based on an 85-deg C maximum operating temperature. Higher ratings for special applications may be obtained by use of high-temperature terminations. Maximum recommended working voltage is 600-v. a.c. or d.c.

The cable bends readily for easy installation and can be secured to any surface by standard cable clamps or straps. No special boxes or equipment attachments are required for this wiring.—General Cable Corp., 420 Lexington Ave., New York 17, N. Y.



#### Multi-Speed Unit Transmits Power

Three new models of multi-speed power units are offered for power transmission up to 60 hp. These units are said to be ideal for varying the speed of electrically driven equipment or machinery. They are also used with internal combustion engines to vary output speed at a constant engine

Transmissions are available with four speeds and a selection of different speed ratios. Some models can be supplied with six and nine speeds.

Two different motor brackets permit drive motor to be mounted either directly over the transmission or at either side.—Turner Machinery Co., 3453 Terrace St., Kansas City 8, Mo.

#### Elastic Piston Seal Stretches With Movement

A new one-piece molded elastic seal allows modification of diaphragm and piston-operated devices.

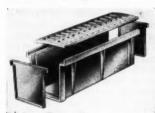
Available in any of a number of rubber compounds, the HydroSeal is essentially a hollow-cylinder of rubber open at both ends. A typical design has a peripheral bead molded inward on one end, thereby restricting the

opening. On the other end the bead is molded outward giving a skirt effect.

Installation of this seal on a ram or piston is made by slipping seal over end of piston, so that restricted end of the seal rests on end of piston. A plate attached on end of piston compresses the peripheral bead against piston, holding it in place.

Skirt on other end of seal can be similarly attached by a holding ring against cylinder shoulder. A completely tight seal is thereby attained and the HydroSeal stretches with the movement of the piston. Piston body supports seal so there is no tendency to rupture under high pressure.

Possible applications of HydroSeal are many. It is said that it can be incorporated in the design of pneumatic and hydraulic motors, glands, shaft seals, valve seals, cylinders, pumps, brake mechanisms and many other devices. Use of HydroSeal for sealing pistons or rams, for instance, eliminates necessity for closely machined surfaces. Application to diaphragm motor valves permits much greater travel distance than possible with a diaphragm.—The Farris HydroSeal Corp., 501 Commercial Avc., Palisades Park, N. J.

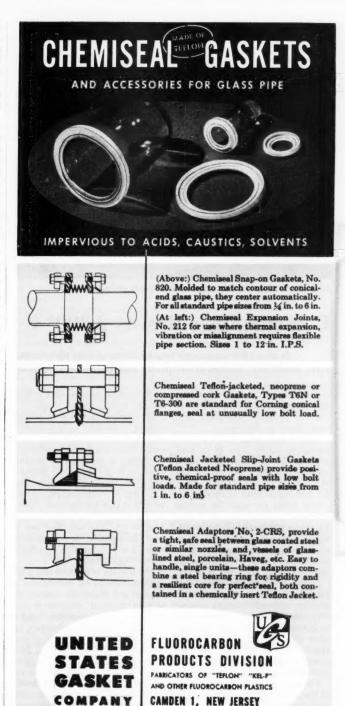


## **Brainage Gutters Are Pre-Fabricated**

You can now obtain pre-fabricated drainage gutters which are ruggedly constructed, easy to install and maintain. A basic pre-fabricated Drain-Master unit consists of a center piece or receptacle, a top grating and two end pieces. Units fit together in slipjoint manner, permitting assembly of any length of drainage installation.

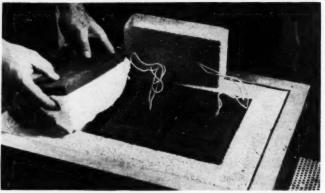
Parts are cast of heavy-duty iron and will sustain heavy loads. A typical unit measures 13 in. x 9\frac{1}{2} in. x 4\frac{1}{2} in. dep. Alternate sizes have depths of 6\frac{1}{2} in. and 8\frac{1}{2} in.

End pieces are available with or without flanged holes. For bottom or side take-off center pieces are available with either one or two flanged holes.—Standard Foundry Products, 220 W. 42nd St., New York 36, N. Y.



of a transport for the best-

## Product News Edited by Frances Arna



Extreme heat leaves Fiberfrax almost untouched, ruins asbestos, glass fiber.

## Ceramic Fiber Resists 2,300° F

It also offers a unique combination of fine fiber structure, resiliency, electrical resistivity and chemical inertness.

There has been just enough testing done on properties of a new refractory fiber to outline widespread and varied future applications.

And Carborundum Co. have seen enough to decide them to up pilot plant production from 30 tons a month to 14 tons a day. By the end of 1953 they plan to have a 45-ton-aday commercial plant in operation.

The fibers are made by melting aluminum oxide and silica in an electric furnace (see p. xxx for process story). A blast of air plays on a stream of the molten mass to produce fibers up to 3 in. in length with an average thickness about 1/25 that of a hair.

Called Fiberfrax, the product has the following outstanding properties: filtration efficiency, inertness to most chemicals, high heat resistance, light weight, low heat transmission, electrical characteristics, sound-deadening ability. These properties are not usually found in combination in manmade fibers or refractory materials.

Fineness and random arrangement of the fibers make the material practical as a superfilter for gases and liquids in chemical operations. In tests they have strained out particles as fine as 0.3 micron. What's more, its inert source and low alkali content make it resistant to acid attack.

Its inertness also makes possible cleaning of the filter by high-temperature calcination. It can then be reused without loss of filtering efficiency.

Fiberfrax is unchanged by temperatures up to 2,300 deg. F.; does not soften at temperatures approaching 3,000 deg. F. Natural asbestos cannot be used at such temperatures; furthermore it is largely imported and often hard to get. The new fiber can be used immediately in combination with, or as a replacement to, asbestos in many applications.

The fineness of the fiber makes it a practical material for manufacture of thermal and electrically resistant papers in electrical components subjected to high temperature service. The Naval Research Laboratory has extensively studied its electrical insulation uses (see CE, July '52, p. 248).

It can be bonded into insulating panels that will not only resist fire and prevent heat loss but will also deaden sound. As now produced, it can compete directly with extremely fine glass fibers in many applications. Insulation tests show that the fiber, as compared to high-quality refractory insu-

lating brick, can make impressive savings in weight and furnace efficiency.

Its resilience makes it suitable for vibration dampening and as a packing material for expansion joints. The smooth vitreous surface and long length of the fibers probably accounts for this resilience.

Although it is produced and collected in a fluffy mass, Fiberfrax fiber eventually will be processed into felted blankets, firmly bonded batts, tape and paperlike forms.—Carborundum Co., Niagara Falls, N. Y.

### Refrigerant

Nonflowing, outlasts ordinary ice.

A startling new refrigerant in the form of a colloidal gel has recently been developed. Called Sno-Gel, it's a nonflowing "ice" that outlasts ordinary ice three to five times. Its temperature can be regulated, and it can be used until it wears out.

Sno-Gel is a mixture of a nontoxic inorganic compound in the form of a white powder and water. The resulting colloidal substance looks as innocuous as a blob of jelly, but when it's frozen it can be used to refrigerate everything from brook trout to orchids without freezing them. It has no objectionable gas like dry ice.

One of Sno-Gel's best points is that its temperature isn't limited to the 32 deg. F. of ice or the -109 deg. F. of dry ice. It can be frozen at a wide range of temperatures, but Sno-Gel will be produced commercially to freeze between -8 and 30 deg. F. Like turning the dial of a refrigerator, the temperature of Sno-Gel can be changed by formula. A switch in the eutectic point or the amount of the compound will change the point where the gel will freeze. Mix the compounds with hot water instead of cold and you get a greater volume of gel and a lower freezing point.

One thing that appeals to shippers is the absence of water run-off with Sno-Gel—the water is held in suspension even after the refrigerating effect has been completely exhausted. While ordinary ice forms a quick plug of cold at 32-34 deg. F., then gets drippy, Sno-Gel produces a more con-

stant rate of heat absorption. When it starts to unfreeze, the outside temperature drops first, the surface structure stays the same. Sno-Gel retains approximately its original size when expended, so void spaces in containers are eliminated, preventing loosening and shifting of merchandise in transit.

The product is put out in a variety of colors and packages. Color indicates the temperature. Since it can be molded or poured into any shape or form, it is sold in uncovered blocks, slabs, tubes, as "crushed ice", in heavy wear-resistant bags for hard use, and in polyethylene bags for packing in food displays.

The cost of Sno-Gel is completely competitive with wet or dry ice depending on the eutectic point desired and whether it is used more than once. If Sno-Gel is used once and thrown away, its cost is mid-way between wet ice and dry ice. If it's reused several times, it will be cheaper than ordinary ice.

In production only two months, the manufacturer has sold all the Sno-Gel it can produce in its two plants in Oakland, and will have to expand its facilities elsewhere. Future market possibilities are considered unlimited, but the company is setting its sights for about 15 percent of the ice business when it gets into full production.— Chemical & Fibre Associates, Inc., Oakland, Calif.

#### Orthodichlorobenzene

A new extremely pure form for synthesis of dyestuffs, intermediates, pharmaceuticals, rubber chemicals.

A pilot plant technique for the manufacture of an extremely pure orthodichlorobenzene has been perfected. Samples are available for experimental use of a grade having less than ½ percent total impurities which it is believed will prove of great value to manufacturers of various organic chemicals.

Commercial grades have previously contained relatively large proportions of impurities in the form of other chlorobenzenes. These impurities, which are difficult to remove, interfere with many organic chemical reactions by inducing undesirable side reactions.

IN BRIEF-A capsulated listing of this month's newsworthy products

It's New	It's Good For	See	Page	θ
Ceramic Fiber	Insulation, filters, packing materials			. 19
Refrigerant	Nonflowing nonfuming ice or dry ice substitute			. 19
Orthodichlorobenzene	Preparation of dyestuffs, intermediates			. 19
Propyl Acetate	Economical replacement for solvents like MIB	S		. 19
Chiorine Trifluoride	Manufacture of fluorine, chloro-fluorine chemic	cals.		. 19
Oxychloride Cement	Shock resistant linings for freight cars			. 20
Kel-F	Valve diaphragms, drum and tank liners			. 20
Insulating Resins	Hermetically sealing electrical components			. 20
Resin	High-tensile-strength, chemical resistant cemen	t		. 200
Hydrogen Peroxide	Food processing		****	. 20

grade is expected to provide greater uniformity of shade from batch to batch. In certain applications commercial grades of orthodichlorobenzene leave undesirable residual odors due to high boiling components such as trichlorobenzenes. As these undesirables are completely removed from the new grade, this faster evaporating product should be the preferred solvent in commercial stains, dyes, varnishes and polishes.

The pure ortho is prepared under carefully controlled conditions in specially designed equipment. For this reason it is possible to hold within rigid limits the dielectric constant and other physical properties which are influenced by the presence of contaminating impurities. The control and uniformity of the dielectric property has attracted attention for solvent use in the measurement of dielectric constants of such materials as vegetable oils, natural resins, gums, and similar products.

If a substantial market is developed for the new product as the result of experimentation by companies taking samples of the high-purity orthodichlorobenzene, the manufacturer will install facilities for its manufacturer in quantities to meet the demand—Product Development Dept., Solvay Process Division, Allied Chemical & Dye Corp., 40 Rector St., New York 6, N. Y.

#### **Propyl Acetate**

An economical replacement for solvents like MIBK and butyl acetate-ethyl acetate combinations.

Available in 90-92 percent concentration, n-propyl acetate is a medium boiling, low viscosity solvent. The clear water white appearance and pleasant odor of the ester enhance its value as a lacquer solvent.

In nitrocellulose formulations at practical diluent levels, n-propyl acetate's lower viscosity allows the use of a higher percentage of naphtha diluent than MIBK or any other ester combinations. It also will afford a very superior solvency with the synthetic resins.

Because of its high naphtha tolerance it has a price advantage over other active solvents. Nitrocellulose solutions containing n-propyl acetate also tolerate more toluene than those which contain other ester combinations and rank closely with solutions which contain MIBK as the active solvent.

N-propyl acetate is a good solvent for other cellulosic materials such as cellulose acetate butyrate, ethyl cellulose acetate butyrate, ethyl cellulose and other plastic compounds such as polystyrene. These materials including nitrocellulose are used in the production of synthetic leather, coatings for fabrics and decorative finishes for plastics.—Celanese Corp. of America, Chemical Division, 180 Madison Av., New York 16, N. Y.

#### **Chlorine Trifluoride**

For use in the manufacture of fluorine and chloro-fluorine chemicals.

Chlorine trifluoride, which contains 61.7 percent fluorine, is now being produced on a commercial scale by direct reaction between fluorine and chlorine. It is generally comparable to elemental fluorine in reactivity and other characteristics. Its rate of reaction is somewhat less permitting more accurate control in the manufacture of fluorine chemicals.

An outstanding advantage of chorine trifluoride is convenience of handling, storage and shipping. While fluorine must be shipped in cylinders under high pressure, chlorine trifluo-

ride can be shipped as a liquid under pressures of only 10 to 20 psig.

A nearly colorless gas at atmospheric temperature and pressure, it boils at 11 deg. C. and melts at -83 deg. C. Liquid chlorine trifluoride is soluble in all proportions in liquid chlorine and, in addition, in liquid hydrogen fluoride.

Chlorine trifluoride is an incendiary causing immediate ignition of many organic substances. The direct action of chlorine trifluoride upon organic compounds is usually vigorous and may result in the formation of a large proportion of carbon tetrafluoride. Under controlled conditions however, fluorine and chlorine may both be introduced into the organic molecule. Chlorine trifluoride will react just as strongly with such siliconbearing compounds as elemental fluorine.

Higher-valence metal fluorides are formed when chlorine trifluoride displaces chlorine and other halogens from solid metal halides or oxygen from metal oxides.

These properties suggest the use of the compound in the manufacture of fluorine and chloro-fluorine chemicals, as an oxidizing agent in rocket fuels, and in the production of high temperatures for cutting metals and siliceous materials.

Liquid chlorine trifluoride is packaged in steel cylinders, in unit quantities of 5, 10 and 100 lb.—Pennsylvania Salt Mfg. Co., 1000 Widener Bldg., Philadelphia 7, Pa.

### **Oxychloride Cement**

Plastic cement now used to provide shock resistant lining for freight cars.

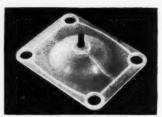
To form a tough resilient for new or worn flooring and walls, many leading railroads are turning to oxychloride plastic cement.

Magnesium oxide, an essential ingredient is supplied by Westvaco Chemical Division. The cement also contains asbestos, magnesium oxide and wood fiber.

Easily applied, the lining is said to be as rugged as cement, as smooth as plaster yet as nailable and shock-resistant as wood.—Westvaco Chemical Division, 161 East 42nd St., New York, N. Y.



TANK LINER





VALVE DIAPHRAGM

VALVE SEATS

## Cashing In on Kel-F

Unique combinations of properties promise that Kel-F's recent success as a regular commercial product is only the beginning.

The Kel-F bandwagon is really beginning to roll. New applications in both civilian and military fields are taking advantage of properties which are unique even among the fluorocarbons.

These outstanding properties include chemical inertness, electrical resistance, zero moisture absorption, ability to withstand high and low temperature, moldability and machinability. Chemically polytrifluoromonocthylene, Kel-F owes much to its one chlorine atom.

Cashing in are such uses as valve diaphragms, valve seats and gaskets, drum and tank liners, flexible noncorroding containers, O-rings, coated wire, rotary electric switches, machined chemical and electrical fittings. The list is getting longer all the time.

So much so that Kel-F's manufacturers, M. W. Kellogg Co., have been encouraged to build new \$1 million production facilities in Jersey

City, N. J. The company has produced it on a commercial basis since 1947. Originally the Manhattan project operated a pilot plant simply to fill the needs of the U-235 plant.

Kel-F made its debut in the Oak Ridge gaseous diffusion plant. Its resistance to highly corrosive materials spurred its use there.

In the valve field, Kel-F has filled a long standing materials need.

The diaphragm-type valve has many advantages in certain chemical processing flow applications. However, its efficiency depends on the diaphragm. Kel-F diaphragms (1) provide the necessary flexibility over a wide temperature range; (2) are completely inert to even the most corrosive chemicals.

The product retains its properties from -320 deg. F. to 390 deg. F. As for chemical inertness—no effect has been observed after prolonged exposure of Kel-F to concentrated sul-



How Celite Mineral Fillers make a product free-flowing . . .



## Keeping fertilizers "On the run"

REALIZING their product is one that cannot "cake-up" and still survive in a competitive market, leading producers of fertilizer use one of the Celite Mineral Fillers as a standard "anticaking" ingredient.

The ability of Celite Fillers to keep a product free-flowing results from their

high absorption properties and unique diatom structure—properties which make them unusually effective safeguards against caking in deliquescent materials. They are two of the unusual physical characteristics that adapt these diatomaceous silica powders to numerous industrial uses.

## THESE CELITE PROPERTIES BENEFIT MANY TYPES OF PRODUCTS

Because of their inertness and great bulk per unit of weight, Celite Mineral Fillers make ideal bulking agents for powders and pastes. Their tiny multi-shaped particles interlace to stiffen and strengthen admixtures. The microscopically small facets of these particles diffuse light so effectively that they can be utilized to impart any desired degree of flatness to a surface film. Their light, porous nature improves suspension, helps prevent segregation. And their porous, thin-walled cellular structure imparts a delicate non-scratching abrasive action.

You may find Celite the "extra something" needed to lift your product above competition. Why not discuss its application to your problem with a Celite engineer? Or write for further information and samples to Johns-Manville, Box 60, New York 16, N. Y. In Canada: 199 Bay St., Toronto, Ont.

CHECK LIST OF PRODUCT BENEFITS OBTAINABLE AT LITTLE COST WITH CELITE MINERAL FILLERS

- Added Bulk
- Better Suspension
- Faster Cleaning Action
- Greater Absorption
- Improved Color
- Better Dielectric Properties
- More Durable Finish
- Increased Viscosity
- Elimination of Caking
- Higher Melting Point
- Better Dry Mixing
- Improved Dispersion



## Johns-Manville CELITE

MINERAL FILLERS

That's right. It takes one man just one minute at the nozzle of this latest model Kidde Wheeled Extinguisher to discharge all of 150 pounds of firechoking dry chemical. And, Mister, 150 pounds of dry chemical can snuff out a mighty big fire.

Kidde's "instant flow" nozzle and adjustable hand control means you can beat back fire with a 30-foot-range "straight stream" or blanket it with an improved "fan" pattern.

If you want really powerful protection against exceptionally large fires in live electrical equipment, flammable liquids, textiles, etc., you want a *Kidde* 150 pound Dry Chemical Wheeled Extinguisher. Write today for full information





Walter Kidde & Company, Inc., 928 Main Street, Belleville 9, N. J.





sistant to most organ

acids; to strong acids; to fuming nitric acid, aqua regia and other vigorous oxidizing materials. It is equally resistant to most organic solvents.

phuric, hydrofluoric and hydrochloric

PRODUCT NEWS, cont. . .

Thus, one recent application of special interest is a lining made for a large chemical vessel handling an extremely corrosive acid. A complete vessel itself, the liner was fabricated from Kel-F sheet and tubing and measures 18 ft. long by 3 ft. in diameter. Its object is to completely protect the costly metal vessel from any possible corrosive attack.

Future applications of Kel-F are now in the works in many fields such as lubricants, packaging and electronics

Researchers visualize lubricants with perfect properties. The fluorohalocarbon is not limited by instability to oxidative degradation the way the products of the hydrocarbon and metallurgical field are.

They have already been able to tailor a product with stability to oxidation, low vapor pressure and high degree of oiliness. Yet to be built in is a high viscosity index.

Kel-F also entices forward-looking men in the packaging industry. It has the strength and corrosion resistance of metals. But it also can be shipped in collapsible form.

Coupled with its low water absorption, these properties make Kel-F ideal for the packaging of chemical and food products. In food packaging in particular, its low temperature properties recommend it for deep freeze operation.

Kel-F will probably strengthen the trend in electrical equipment design toward smaller, more compact units. When Kel-F insulation is used, it has been calculated that if one could run the temperature up to 300 deg. F. it would be possible to get three times the horsepower from a given motor certific.

In developing Kel-F applications, Kellogg engineers have gotten together with the country's leading molders. Techniques are now available by which the material can be readily molded on all types of standard production equipment. Other forms of Kel-F were also developed including plasticizers, oils, waxes, greases and dispersions. The dispersions have an infinite variety of applications in protecting more vulnerable materials.



## SAFER, MORE DURABLE TIRES

have been achieved by taking advantage of many scientific advances. One of the most important has been the development of resorcinol-formaldehyde resins to give a dependable rubber-to-cord adhesion for the lifetime of the tire. This superior adhesion, a critical factor in the successful use of rayon cord, is even more important with the high strength nylon cord recently adopted for extreme service conditions. Heyden Resorcinol, Technical, is specified by many manufacturers of tires, heavy-duty belting, and other fiber-reinforced rubber products.

PLYWOOD ADHESIVES Manufacturers also specify Heyden Resorcinol, Technical. Cold-setting resins made from it and formaldehyde are easy to use and provide unusual strength and weather-resistance.

OTHER APPLICATIONS for Heyden Resorcincl—either the technical or USP grade—are as an intermediate for the synthesis of dyestuffs, developers, fluorescent compounds, plastics, tanning agents, antioxidants, and pharmaceuticals.

**HEYDEN RESORCINOL** Technical Flakes, is shipped in 250 pound fiber drums. The USP Crystals are shipped in 100, 50 and 25 pound drums. Samples and further information are available on request.

## SERVING INDUSTRY THROUGH FINER CHEMICALS

Benzaldehyde • Benzoates • Benzyl Chloride Bromides • Chlorinated Aromatics

Creosotes • Formaldehyde • Formic Acid

Glycerophosphates • Guaiacols

Medicinal Colloids

Methylene Disalicylic Acid • Neomycin

Paraformaldehyde • Parahydrozybenzoates

Penicillin . Pentaerythritols

Propyl Gallate • Resorcinol • Salicylates

Salicylic Acid • Streptomycin

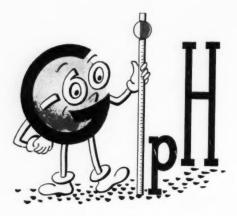


HEYDEN CHEMICAL CORPORATION

352 Maasea Avenes, new tont 17, h.v.

## DARCO G-60

## is equally effective over the entire pH range!



You can make the most of the outstanding advantages of this activated carbon of premium purity regardless of the pH of your solutions. Darco G-60 often makes possible the simplification of processes with substantial savings in time and costs.

Darco G-60 gives you the ideal combination of maximum filterability, high adsorptive capacity, and low retention loss—plus freedom from extractable contaminants.

Write for the complete story and a sample of this outstanding carbon today.

#### IMAGINUITY AT WORK

In decolorization of materials sensitive to oxidation, activated carbon may introduce enough air in its pore structure to cause trouble. Solution: boil the carbon vigorously with water (or other suitable solvent) for twenty minutes to expel air; decant or filter; and use.

#### DARCO G-60

Highest purity ... by the gram or carload



PRODUCT NEWS, cont. . .

from virtually any corrosive material.

Today more than 50 leading molders in the country are supplying not only finished products, but also a large line of fabricating materials such as Kel-F molded sheets; extruded and molded rod; extruded tubing, thin film and molded strip. Scores of other companies are using Kel-F in manufacturing component parts for their own products.



### **Insulating Resins**

For hermetically sealing off electrical components from adverse conditions.

A tough protective coating for coils, transformers and other electrical components designed for critical applications is offered by two new epoxy type resins. They boast high dielectric strength and moisture resistance.

The unit may be embedded in a solid block of resin. Or the resin may be used for dip impregnation on coils. More resistance to moisture is afforded than by the conventional varnish-impregnated paper and cloth insulation.

Scotchcast electrical insulating resin No. 1 comes in a solid form together with a catalyst and is heated until liquefied for pouring into the mold. The resin then sets and is cured at 250 deg. F. in from four to eight hours. Scotcheast electrical insulating resin No. 2 comes in a liquid form together with a hardener and can be poured into the mold and cured at room temperature in from three to six hours.

Either type may be used for most applications depending on available production facilities. In the case of electronic components unable to withstand high temperatures, the No. 2, cold-pouring type may be required.

Outstanding features of the new insulating resins are their 100 percent solids nature with no volatile products and a minimum of shrinkage upon



"BUILT TO THE SAME SPECIFICATION STANDARDS - I THOUGHT ALL STEEL VALVES WERE ALIKE AS TWO PEAS"

## OIC BUILDS FROM THAT POINT UP

## LOOK AT THESE FOUR FEATURES:

## 2-PIECE YOKE DESIGN

simplifies replacement of yoke nut. Permits replacement of yoke nut without shutting down the line. Yoke nut is OIC Alloy 40; non-galling material.

## 3 OIC'S SEAL-EVER

(exclusive with OIC) lasts 10 to 15 times longer than ordinary packing. It stops pitting and corrosion of stems.

## 2 STUFFING BOXES

have greater depth than is specified, permitting the use of 7 to 9 rings of packing, with either wiper rings or condensing chamber below.

## 4 SEAT RINGS

are end-seated and are subjected only to compression forces when valve is closed; no loosening of seat rings with repeated opening and closing of the valve. No open spaces to cause turbulence, accumulate dirt and hasten corrosion.

## THE BEST STEEL VALVE YOU CAN BUY

This combination involving yoke design, stuffing boxes, packing and seat rings is evidence of OIC's desire to build beyond minimum specifications.

THE OHIO INJECTOR COMPANY, WADSWORTH, OHIO



VALVES

FORGED AND CAST STEEL . IRON . BRONZ





## HELICOID Chemical Gage

## The gage that retains its original accuracy longer, lasts longer, costs less per gage, per year



 For chemicals and liquids which would corrode or clog the Bourdon tube. Simple, sturdy construction proved in the field.

Pressures to 3000 p.s.i., vacuum, or compound; temperatures to 400° F. Diaphragm unit may be ordered separately.

## FEATURES



• The Helicoid movement is a simple cam and roller arrangement that gives long, trouble-free service. It has no gear teeth to wear out. Helicoid Gages are made in various sizes and shapes, with black, white, or phosphorescent dials. For wall or stem mounting. Helicoid Gages cost less in the long run.



Write today
for the Helicoid catalog

HELICOID GAGE DIVISION
AMERICAN CHAIN & CABLE

927 Connecticut Avenue - Bridgeport 2, Connecticut

HELICOID

Pressure

Vacuum

GAGES

PRODUCT NEWS, cont. . .

curing; no chemical degradation within the operating range from -40 deg. F. to 250 deg. F.; resistance to acids, alkalies, solvents and oils, and excellent adhesion to most metals, plastics and conductors.

Both resins have a dielectric strength of approximately 1,000 v. per mil on thin sections. Neither material will support combustion, both are inert to fungus and both may be machined, drilled, tapped, ground or turned.

Filler materials such as aluminum oxide, mica or glass may be used with the resins for improving physical, electrical or chemical properties.

Both materials are available currently in quantities up 2,000 lb. a mo.
—Minnesota Mining and Mfg. Co.,
900 Fauguier St., St. Paul, Minn.



#### Resin

Will not crack or check like furfuryl alcohol resin, right.

A new resin used as a chemical-resistant cement is said to provide higher tensile strength, improved resistance to oxidizing solutions, better water and thermal stability.

When compared to furfuryl alcohol resin, the new product exhibits a notable improvement in shrinkage, according to the manufacturer. It will not crack, check or warp.

Called Fura-Tone 1347, it is suggested as a substitute for furfuryl alcohol resins for lining tanks, or as a cement for chemical bricks to obtain superior chemical and physical properties.—Irvington Varnish and Insulator Co., Chemical Products Division, Irvington 11, N. J.

Hydrogen peroxide is now available in a grade specially developed for food processors. The new grade, designated Becco hydrogen peroxide 35 percent. Formula F, does not contain organics.—Buffalo Electro-Chemical Co., Station B, Buffalo 7, N. Y.

## Girdler Process News



## **GIRDLER DESIGNS AND BUILDS**

## new synthetic nitrogen fertilizer plant for Mississippi Chemical Corporation

Mississippi Chemical Corporation assigned complete responsibility for engineering and construction of its new integrated plant to one experienced source... The Girdler Corp. Original cost was lower than estimates from other sources, and also ammonia, nitric acid, and ammonium nitrate are now produced with a lower unit energy input than in any other similar plant.

The plant is a complex one, involving production processes for hydrogen, nitric acid, ammonium nitrate, etc. This is one of the few

high-pressure, catalytic-process ammonia plants in the U. S. Methods for safe handling of gases at pressures up to 15,000 pounds per square inch had to be worked out.

Girdler has broad experience in handling such complete "process packages"... covering design and construction of process plants involving very high operating pressures, high temperature reactions, and corrosive substances.

Call on Girdler in the planning stages of *your* processing facilities ... you can do so with confidence.



## Synthesis gas plant

This unit at Mississippi Chemical Corporation manufactures high purity synthesis gas needed for the production of ammonia. Natural gas is the primary raw material. Superheated steam, used in the synthesis process, is produced by integrating steam generation with process functions. Thus the cost of a separate steam plant was saved.



### **Prilling tower**

Limited, Toronto.

Final step in production of ammonium nitrate. The complete plant has various improvements in design and layout, and process combinations never before used. Proper coordination of countless details by Girdler was a major factor in low first cost of plant.

#### **Want More Information?**

Girdler's Gas Processes Division designs and builds plants for the production, purification, or utilization of chemical process gases; purification of liquid or gaseous hydrocarbons; manufacture of organic compounds. Write for Booklet G-35. The Girdler Corporation, Gas Processes Division, Louisville I, Kentucky, District Offices: San Francisco, Tulsa, Atlanta, New York. In Canada: Girdler Corporation of Canada:

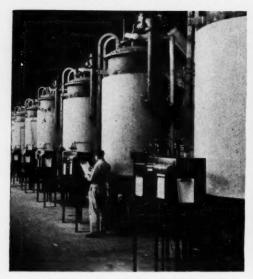


Gas Processes Division

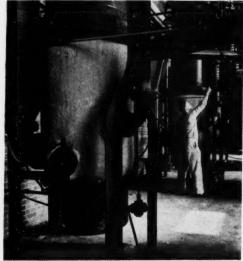
Votator Division

Thermex Division

PROCESS ENGINEERS . DESIGNERS AND CONSTRUCTORS . MANUFACTURERS OF CATALYSTS



In first step in the production of phthalic anhydride, crude naphthalene is injected into vaporizers.



2 Phthalic anhydride vapors from the converter are cooled in these units to a point just above the dew point.

## Phthalic Anhydride

## from Napthalene



NAPHTHALENE is still by far the largest source of phthalic anhydride, although several commercial-scale plants have recently gone on stream to make the product from orthoxylene.

The pictured flowsheet herewith shows the production of phthalic anhydride from naphthalene at the Detroit plant of Reichhold Chemicals, Inc. Reichhold is the largest consumer of phthalic anhydride in the alkyd resin business. Its first plant to produce phthalic anhydride from naphthalene was built in 1939 at Detroit. Since then two more plants have been completed at the same location. Combined plants now turn out about 25 million lb. per year.

Naphthalene is derived from coal tar which is a byproduct from coking of the coal that goes into steel production. Its supply depends on availability of coal and the production of steel. Impetus to the production of phthalic anhydride from orthoxylene has been given by the demand for the meta and para isomers of xylene for use in aviation gasoline. Orthoxylene is detrimental to aviation gasoline, hence it is available for the production of phthalic anhydride.

Largest outlet for phthalic anhydride is alkyd resins, consuming about 55 percent. Next largest outlet: phthalate esters for plasticizers (about 30 percent). Dyestuffs account for about 10 percent of the phthalic anhydride production.

Phthalic anhydride, C<sub>6</sub>H<sub>4</sub> (CO)<sub>2</sub>O, is the anhydride of phthalic acid, an aromatic polybasic organic acid. It is in

the form of translucent, white crystalline needles or flakes (liquid also for shipment in tank cars), is soluble in alcohol, slightly soluble in ether, and very slightly soluble in water.

Production of phthalic anhydride from naphthalene involves partial combustion with air. Carbon dioxide and water are also formed. Yield is generally between 70 and 80 percent.

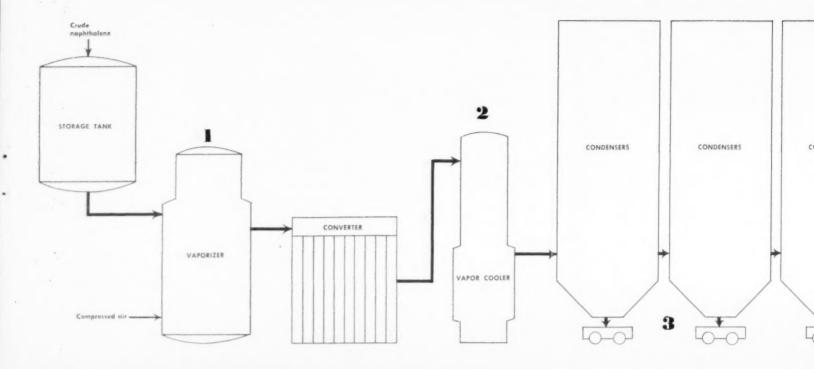
Each ton of phthalic anhydride requires about 14 tons of naphthalene and a large excess of pressurized air.

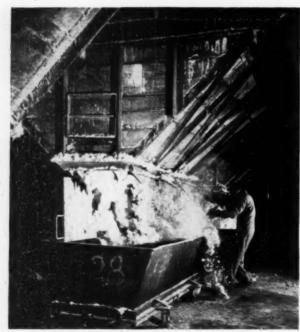
Supported heavy metal oxides serve as a catalyst for the conversion, which requires 0.1 sec. contact time. Heat is removed from the catalyst chambers in the case of the Reichhold installation by a heat exchanger that is built into the converter itself. Molten salt or mercury are generally used to remove this heat.

The vapor cooler reduces the temperature of the exit gas to a point just above the dew point. Condensation of phthalic anhydride takes place on the walls of the condenser boxes. After remelting, purification is made by distillation.

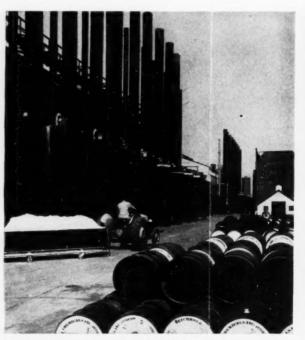
Maleic anhydride is formed as a byproduct of the reaction, and may be removed by working up the crystals in the last compartment of the condenser box system or by scrubbing the tail gases from the condenser boxes. Most commercial phthalic anhydride contains 0.25-0.40 percent maleic anhydride.

Phthalic anhydride is also produced from naphthalene using a fluid catalyst of very finely powdered vanadium pentoxide.





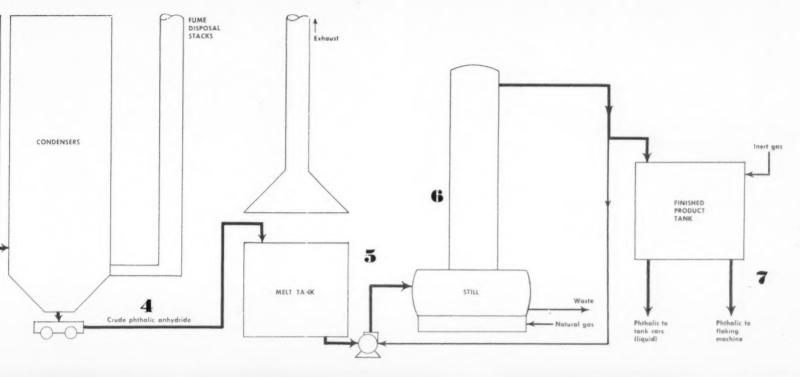
Condensation of phthalic anhydride takes place on the walls of these condenser boxes, one of which is being unloaded here.



Phthalic anhydride on way to melt tank passes odor removers and fume disposal stacks handling exit vapors from condenser boxes.

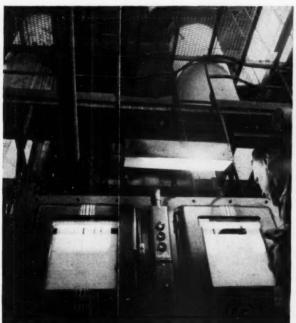


Crude phthalic anhydride being pushed Melting is done in an inert gas atmosph





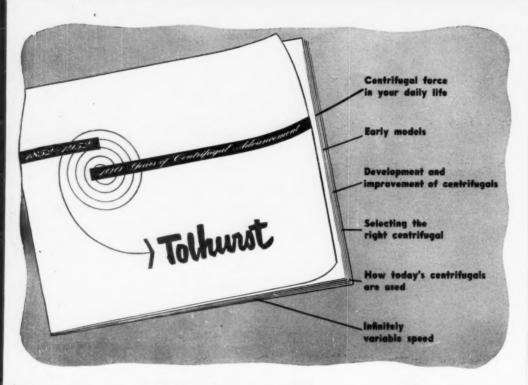
ing pushed into melt tank prior to purification. gas atmosphere.



6 Checking readings at base of distilling columns which purify the crude melted phthalic anhydride. Natural gas furnishes the heat.



Finished phthalic anhydride coming off flaking machine goes into drums for shipment. It is also shipped as a liquid in tank cars.



## Our First 100 Years Were the Hardest

I'N' 1852 eight years before Lincoln was elected president, Tolhurst Machine Works was founded in Troy, N. Y. Judged by today's standards, early centrifugals were crudely constructed and excessive vibration was a serious problem. When our catalog for 1885 described the new Tolhurst Self-Balancing Centrifugal as one "which will not jar the building," this development was hailed as a remarkable achievement.

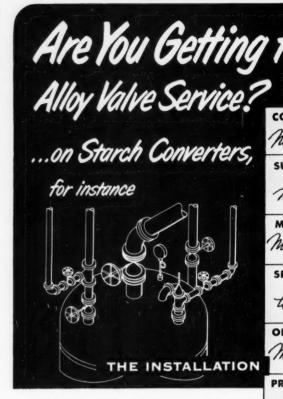
In the hundred years since 1852, Tolhurst has met many problems and learned quite a little about designing and building centrifugals for American industry. If YOUR plant has a problem that involves filtering, draining, dehydrating, thickening or separating, perhaps we can help you handle it better and more economically by utilizing centrifugal force. Our experience is at your service without cost or obligation.

Highlights of Tolhurst's first hundred years have been compiled into a brochure for your library, colorfully illustrated with sketches of early events and machines as well as modern installations. To receive your complimentary copy, fill in the coupon below.

# Tolkurat CENTRIFUGALS DIVISION

AMERICAN MACHINE AND METALS, INC.

TOLHURST CENTRIFUG American Machine and	Metals, Inc. Dept. CE952
East Moline, Illinois	
☐ Send me a copy of Tolhurst anniversar	the y brochure.
☐ Have your represent	ative call on me.
☐ Have your represent	ative call on me.
	ative call on me.
Сомраву пате	ative call on me,



Crane Ni-Resist valves on starch inlet lines to converters, Corn Products Refining Co. plant, Argo, Ill.

## THE HISTORY

Valves in this service are constantly exposed to hydrochloric acid vapors under working pressure of 50 psi at approximately 280 deg. F. None of the valves formerly used lasted more than 2 to 3 weeks without repairs. In 3 to 4 months they had to be retired from service for rebuilding. Maintenance costs were excessively high.

To stop the trouble, the plant chose Crane Ni-Resist Alloy Cast Iron Gate Valves with Crane 18-8 Mo trim. Since being installed, these valves have operated at highest efficiency. On last inspection after 19 months' uninterrupted service, they were still in excellent condition.

The Complete Crane Line Meets All Valve Needs. That's Why

More Crane Valves Are Used Than

comb

prop

stant

erosi

trim,

chem

cast i

datio

call y

## **CRANE VAL**

CRANE CO., General Offices: 836 S. Michigan Ave., Chica Branches and Wholesalers Serving All Industrial A

VALVES . FITTINGS . PIPE . PLUMBIN

CHEMICAL ENGINEERING—September 1952

## ng this Low-Cost

VALVE SERVICE RATINGS

CORROSION-RESISTANCE:

ni-Resist OK-18-8 Mo trim ideal

mildly consure service

MAINTENANCE COST:

none-except routine stuffing box

SERVICE LIFE: 5 times longer to-date than other values

**OPERATING RESULTS:** 

much less process interruption

NC

In line

AVAILABILITY:

Regular Crane Catalog item

## THE VALVE

Crane Ni-Resist Cast Iron Gate Valves combine, at moderate cost, the physical properties of quality cast iron with substantially greater resistance to corrosion, erosion, and wear. With 18-8 Mo Alloy trim, they step up valve efficiency on many chemical process services where common cast iron is inadequate. For recommendations, see your Crane Catalog, or call your Crane Representative.

Jsed Than Any Other Make!

Ave., Chicago 5, Illinois ndustrial Areas

UMBING . HEATING



DRYING GRINDING SEPARATING COOLING

SULPHATE COPPER

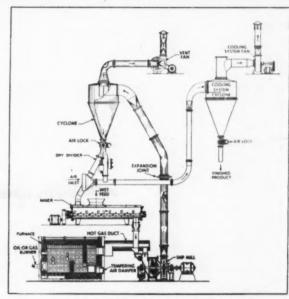
Here is another Raymond Flash Drying application that offers cost-saving advantages for many different types of products.

The diagram on the right shows a compact drying-grinding system for handling Basic Copper Sulphate. For this operation, a Raymond Imp Mill is used with Flash Drying accessories and cooling stage equipment.

The mill system takes the wet feed, containing up to 50% moisture, and dries it to less than one-half of 1% moisture content. At the same time, the material is pulverized to about 95% passing 325 mesh. The finished product is discharged from the cyclone collector through the cooling system ready for bagging.

Economy of installation, low power requirements, high heat efficiencies, shortened production time, close control of particle size and moisture content, are practical reasons why Raymond Flash Drying Equipment is widely used for many materials.

Write for RAYMOND Flash Drying CATOLOG No. 54-A



Flow sheet of Raymond IMP MILL with Flash Drying Accessories and Cooling Stage Equipment.

1311 North Branch Street Chicago 22, Illinois

aymond

Sales Offices in **Principal Cities** 

## Chemical Engineering News



## **Dextran Pinch-Hits for Plasma**

New producers swell output of vital plasma substitute. It's made by fermentation process, followed by hydrolysis and tricky fractional precipitation.

One chemical company after another is getting into production of dextran, a blood plasma expander. Military demands are taking all their output right now. Dextran is currently being evaluated under battle conditions at the front in Korea.

• Commercial Solvents has just completed a \$1.5 million plant at Terre Haute, Ind. First plant in the U. S. designed for dextran production, it's rated at over 1 million pints annually. Entire output will go to the government under contracts totaling \$6 million.

• J. T. Baker is likewise swinging into production with existing equipment, is building a brand new plant at Phillipsburg, N. J. The government has given Baker a \$1.5 million contract calling for delivery within a year.

Another producer, Dextran Corp.
of Yonkers, N. Y., will supply material
to Cutter Laboratories of Berkeley,
Calif. Cutter will process the dextran,
becoming the first West Coast company to do so. Cutter is also working
under a \$1.5 million government contract calling for delivery in a year.

• A textile manufacturer is entering the chemical field via dextran. R. K. Laros holds government contracts for dextran production, is building a plant at Bethlehem, Pa. Meantime, a \$100, 000 pilot plant at Dayton, Ohio, is now producing contract quantities for Laros. Process development and pilot plant work have been done by Commonwealth Engineering Co. of Ohio.

► What Is Dextran?—Dextran has been known for more than 100 years. It's the "sugar slime" that blocks pipes and interferes with crystallization in sugar refineries.

The gummy substance has also been a headache to paper makers. In fact, it was a paper maker who first got Commonwealth interested in dextran over a dozen years ago. At that time Commonwealth came up with some industrial uses for dextran in protective coatings, plasticizers and elastomers. Another potential outlet is as a thickener or stabilizer in foods.

However, current importance of dextran stems from its clinical use, a recent development made possible through refinements in manufacture of a product suitable for injection into the blood stream.

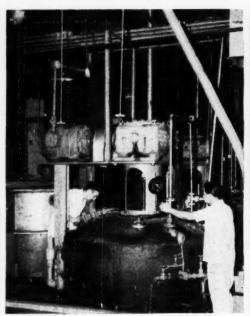
Chemically speaking, dextran is a polysaccharide made up of many molecules of glucose (blood sugar) in a long chain. This polyglucose is chemically related to glycogen or animal starch, which the body stores in the liver.

▶Why It's Important Now—What would happen if one of our big cities were atom-bombed? At present there isn't enough whole blood or plasma in the U. S. to treat the casualties from a single atomic attack on a metropolitan center. Whole blood cannot be stockpiled, and the amount of plasma that can be stored is woefully inadequate.

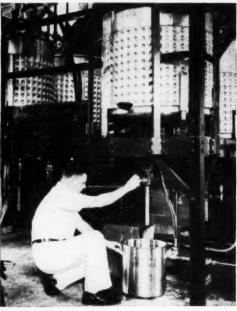
Civil defense planners estimate that metropolitan New York alone requires a stockpile of about 8 million pints of blood plasma or plasma substitute.

Clinical dextran can be produced for about \$7 or \$8 a pint, compared with a current cost of about \$35 per pint for plasma, even when the blood is donated. In addition, it's stable and can be stored indefinitely without refrigeration. Also, since it's already in solution, it can be used instantly in emergencies and is easy to administer.

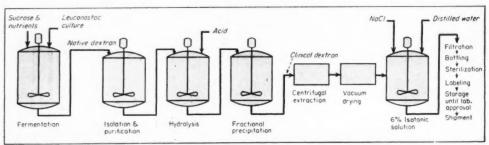
Because it can be sterilized by heat, dextran is free of the virus of hepatitis, which has been transmitted by blood plasma. It requires no blood typing, nor does it interfere with later blood



HYDROLYSIS with mineral acid at Baker's new plant breaks polymer down to dextran of right molecular weight.



SEPARATION by fractional precipitation, most critical step, is carefully controlled in CSC's Terre Haute plant.



FERMENTATION PROCESS converts cane sugar into vital blood plasma substitute in Baker's Phillipsburg operation.

typing for transfusion of whole blood. It does not injure tissues, either locally or systemically.

It serves as a source of nutritional energy. One of the most important advantages of dextran over other possible blood volume extenders is that it is metabolized by the body.

► How Dextran Is Made—Process starts with fermentation of cane sugar by the microorganism Leuconostoc mesenteroides. This organism hydrolyzes sucrose to levulose, most of which it consumes to get its energy, and to glucose. It then builds up the polyglucose molecules that make up dextran.

Different strains of Leuconostoc mesenteroides can produce glucose polymers (dextran) that are not identical, but differ in the degree of branching. The Northern Regional Research Laboratory of the U.S. Department of Agriculture in Peoria, Ill., has picked the best of the 64 strains of the microorganism for the sugar fermentation step. Tabbed NRRL B-512, it produces dextran with the least branching.

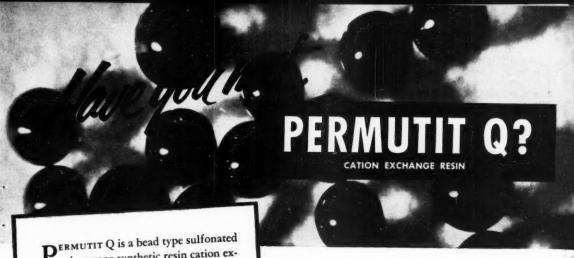
The fermentation, of course, is a batch process. Agitation and aeration, while important, are not as critical as in the production of certain antibiotics.

The fermentation product has a molecular weight far too high (about 2 million) for use as a plasma substitute. Desired range is 50,000 to 100,000.\*

The big processing problem, then, in producing clinical dextran, is to break the long glucose chains down to give the right molecular weight.

After an initial isolation and purification, the long molecules are partially degraded or hydrolyzed; usually with strong mineral acids. (Cont.)

<sup>\*</sup>At molecular weights below 30,000 dextran goes through the renal barrier and is lost without being metabolized, while molecular weights approaching 200,000 interfere with sedimentation and other blood properties.



PERMUTIT Q is a bead type sulfonated polystyrene synthetic resin cation exchanger with high capacity. It is extremely resistant to wide pH ranges, high temperatures and oxidizing conditions, and may be operated on either the sodium or hydrogen cycle.

Forty years have passed since Permutit manufactured the first ion exchangers and applied them to water conditioning. In those forty years, ion exchange as a fundamental scientific tool has been applied in many different fields—and many new ion exchangers have been developed and manufactured by Permutit to meet specific needs.

Permutit is proud of its leadership in the extremely important field of ion exchange. Permutit Q is only one of many Permutit products. At right, a word about a few of the Permutit ion exchangers—some of which may apply to your own field.

Write today for full information and samples.

# Additional Permutit Ion Exchangers

# CATION EXCHANGERS

ZEO-DUR—A processed glauconite, regenerated with salt.

DECALSO — A precipitated gel type sodium alumino.

DECALSO — A precipitated gel type sodium aluminosilicate.

**ZEO-KARB—A** sulfonated coal, regenerated with either salt or acid.

**ZEO-REX**—A sulfonated phenolic type resin. Regenerated with either salt or acid.

PERMUTIT H-70-A high-capacity carboxylic acid resin.

## ANION EXCHANGERS

DE-ACIDITE—An aliphatic amine exchange resin of high reaction speed. Regenerated with Na<sub>2</sub>CO<sub>3</sub>, NaOH or NH<sub>4</sub>OH.

PERMUTIT A—A medium strength exchange resin which removes weak acids from solution. Regenerated with NaOH.

PERMUTIT S — A basic quaternary amine exchange resin. Removes acids as weak as silicic acid from solutions. Regenerated with NaOH.

PERMUTIT

ON EXCHANGE HEADQUARTERS FOR 40 YEARS

This step is carried out in a closed system at no higher than 105 deg. C. No pressure is applied. A mixture of mineral acids is used, principally HC1, often with sulphuric or phosphoric acids.

Molecular weight of degraded hydrolysate depends on the pH and temperature at which hydrolysis occurs.

An interesting sidelight: The British are using ultrasonics instead of acid to break down the long-chain polyglucose. This seems to yield a greater percentage of dextran in the required molecular weight range. While acids usually attack the ends of long-chain molecules, the ultrasonic method apparently breaks the chain in the middle and at other points along its length.

► Fractionation — Degraded dextran contains some molecules that are too large and others that are too small. It is necessary to separate molecules of the right size, and this is done by

fractional precipitation.

The powdered dextran is dissolved in water. Organic liquids, usually alcohols, are then added. Methanol is suitable, and ethanol, isopropanol and acetone have been used by the British. Two or more agents are often added.

The high molecular weight fraction precipitates first and is removed. As precipitation progresses, more of the alcohol is added at each stage. The middle fractions contain the dextran of required molecular weight. Alcohol is recovered and recycled.

► Finishing—After settling, decantation and centrifuging recover the desired fractions. These are blended and dried under vacuum to remove traces of the organic liquids.

The powdered product is stored until cleared by the laboratory, then put into 6 percent saline solution and

bottled.

Primary producers of dextran usually do not prepare this final solution. Instead they ship the powder to pharmaceutical firms for bottling. Commercial Solvents, for example, ships its product to Baxter Laboratories, Morton Grove, Ill.

▶ Research — Swedish investigators first looked into dextran as a blood plasma substitute in the early 1940's. Since then it has also been studied in Great Britain and the United States. Around 1948-49 U. S. military men got keen on the idea.

Commercial Solvents began labora-

tory work in June 1949. For a time this laboratory was the only U. S. source of dextran for medical tests. Process development work, covering a three-year period, included use of material made from radioactive sucrose supplied by Argonne National Laboratories.

J. T. Baker's work dates from 1950. It was in 1950 also that Commonwealth persuaded Laros to look into dextran as a plasma substitute. Commonwealth started its project for Laros in January 1951. Within 15 months it had developed a process. The pilot plant was designed, erected and put into operation within 60 days.

▶ Product Competition—Dextran isn't the only blood plasma extender. Polyvinyl pyrrolidone, an acetylene derivative, was used by the Germans in World War II to treat more than 500,000 battle casualties. It is now being produced here by General Aniline at Grasselli, N. J., and Schenley Laboratories at Lawrenceburg, Ind., is bottling PVP, which it gets from Germany.

While PVP is a potentially strong competitor, at the moment the military seem to given dextran the edge.

# Library Service Offered To Visiting Engineers

A day in the library can often save a month in the laboratory. That's why metallurgists and engineers attending the Exposition at the National Metal Congress in Philadelphia, October 20-24, will want to drop in at Booth No. 1020 at Convention Hall, where the Special Libraries Association will be demonstrating library service. Librarians will offer a quick reference service to visiting metallurgists and engineers.

New books and periodicals will also be on display. Special Libraries Association will have nothing to sell at its booth. It seeks only to demonstrate the value of efficient library service to

technical men.

Visitors can also attend and participate in the sessions of the Metals Section of the Special Libraries Association on Monday afternoon, October 20, and all day on Tuesday, October 21, at the Benjamin Franklin Hotel. On Monday, international cooperation in metallurgical literature classification will be discussed and new mechanical methods for literature han-

dling described. On Tuesday, organization and availability of research reports will be considered, as well as how to get unclassified material from the government, the problems of foreign language literature and its translation, the role of the librarian in technical research, and how to sell the technical library to management. Speakers will represent the Argonne National Laboratory, the Library of Congress, General Electric Co., Timken Roller Bearing Co., Battelle Memorial Institute and Plaskon Co. Chairman presiding at the sessions will be F. M. Ethridge of Consolidated Mining & Smelting Co. of Canada,

# Radioactive Tracers Check Flow Rates of Catalyst

Flow rates of catalyst are checked by radioactive tracers in the Houdriflow catalytic cracking unit of Salt Lake Refining Co. at Salt Lake City, Utah.

In this unit, cracking is accomplished by bringing oil vapors into contact with a solid moving bed of bead catalyst passing downward through the reactor and regenerator. Uniform flow of catalyst is necessary for maximum operating efficiency. However, the determination of flow rates of solid particles inside cracking vessels poses a problem.

Engineers of the California Research Corp. introduced into the unit a few pellets of catalyst impregnated with a radioactive substance. The travel of individual radioactive particles was traced by Geiger counters at various points in the catalytic equipment. Intensity of radiation from the particles was selected at such a value that the path and average velocity of individual radioactive particles could

be plotted.

Results proved that catalyst circulated uniformly through all parts of the Houdriflow unit. For example, the average velocity of catalyst particles flowing down the main seal leg from lift disengager into reactor was measured repeatedly over several weeks with a maximum deviation from the mean result of less than 5 percent. A statistical analysis of results shows that catalyst flow through the Houdriflow system is decidely streamlined and assures uniform residence time of all catalyst particles in the unit.



# Projects... precision packaged for Industry!

More than a third of a century spent solving engineering and construction problems in the Southwest for the biggest names in industry has brought Brown & Root experience that can be invaluable to you.

Regardless of the nature of your project, be it a petroleum plant, chemical plant or public utility, Brown & Root can deliver a turnkey job. From advice on plant location, through flow sheets, design, procurement and construction, Brown & Root will do it better, faster and more economically.

If your firm contemplates construction or expansion in the Southwest or anywhere else, a call from you will put Brown & Root plantplanning experts at your disposal.

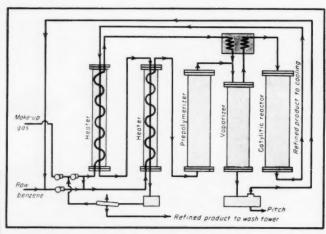


BROWN & ROOT, Inc. Engineers Constructors

CABLE ADDRESS - BROWNBILT

Associate Companies:- BROWN ENGINEERING CORP. 

BROWN & ROOT MARINE OPERATORS INC.



Prepolymerization step stops fouling of equipment by unsaturated components.

# Germans Up Pure Benzene Yield

Catalytic pressure refining of crude benzene from Ruhr coke ovens beats by 10 percent the output of older sulphuric acid treatement.

Much of the crude benzene from Ruhr coke ovens is now being treated by a catalytic pressure refining process developed by Scholven Chemie AG.

The method went into commercial operation in 1950. The 5,000-ton-amounth installation proved so successful that the company expanded to 15,000 tons in mid-1951.

Scholven Chemic's process eliminates the long-standing drawback in pressure refining coke-oven product. Resin-forming, unsaturated components no longer get a chance to foul equipment and thus prevent a continuous working operation. A pressure polymerization following by distillation allows them to be removed as residium before the raw benzene vapors reach the catalytic reactor.

- ► Ideal Method?—A listing of additional advantages attributed to the method makes it sound like something of an ideal—especially when compared with sulphuric acid refining.
- Pressure refining is independent of the quality of the initial product and yields an output of 98 percent.

- The products are free of sulphur and sulphur compounds.
- They can be used at once for fuel purposes without redistillation.
- Simple fractionation will process from the refined product all kinds of high-purity technical products. This is never possible after acid refining.
- The only byproduct is 0.4 percent polymer pitch with a fusion point at over 100 deg. C. Its usefulness as electrode pitch, adhesive material or binding agent is now being tested.
- ► High Capacity, A Must—Pressure refining does have one disadvantage which sulphuric acid treatment does not have: the smallest economical installation must have 5,000 tons capacity.

Production costs in such an installation would only be slightly higher than in the acid refining process. But the latter's 10 percent higher output justifies it, even after deducting from profits the higher freight rates for the raw products.

In the process Scholven Chemie mixes coke gases compressed to 150

atm. (with hydrogen at a partial pressure of 60 atm.) with raw benzene also compressed to 150 atm. Heated to 200 deg. C., the material goes into the polymerizer. The product joins additional coke gases (heated to about 450 deg. C.) in a vaporizer. Raw benzene is evaporated.

Residual liquid, containing polymerized unsaturated hydrocarbons, is distilled and condensed to pitch. About 98 percent of the trouble-making material is thus removed from the system.

From a reheating system where they are brought to a reaction temperature of 350 deg. C, benzene vapors go through a catalytic reactor. Contact agents convert sulphur into hydrogen sulphide, oxygen into water, nitrogen into ammonia. Also any unsaturated hydrocarbons, left after the pre-polymerization, are hydrogenated.

► Catalyst Improved—Until recently the company used a zinc-magnesiummolybdenum catalyst. But its engineers have developed a combination with alumina which is more economical. Also it allows possible carbon deposits at the contact to be roasted in a simple way by carefully adding oxygen.

After leaving the contact oven, the reactants are chilled and a separator takes the liquefied benzenes from the excess coke gases. The gases flow back into the process along with a fresh supply injected by a circulation pump.

Concentration of methane and nitrogen in this cycle requires constant flashing of part of the gases. After an absorber cleanses them of benzene, flashed gases can be used for process heating.

Pressure-refined benzene is released in two pressure stages from 150 to 1 atm. Leaching agent frees it from hydrogen sulphide and traces of ammonia.

Total consumption of hydrogen during the process is 50 to 60 cu. m. per ton at 60 atm. contained in 150 cu. m. coke gas at 150 atm. Some loss of gas is caused by leakages of the stuffing boxes at the gas circulation pump and the solubility of the gas in the product at the flash.

# THE FOURTH DICALITE PLANT



# ..will add approximately 80% increased production capacity for Dicalite calcined and processed filteraids and fillers

The new plant of the Dicalite Division, Great Lakes Carbon Corporation, at Lompoc, Calif., is now in volume production at a continually increasing rate. It represents over 5 years of engineering, design and construction, and is the largest complete unit for processing diatomite built in the last 22 years. Full designed output will add approximately 80% increased production capacity for Dicalite calcined and processed filteraids, fillers and other materials.

The timing is fortunate in view of the emergency

situation in the supply of diatomaceous products. Four Dicalite plants are now running 24 hours a day to produce the maximum tonnage of Dicalite materials.

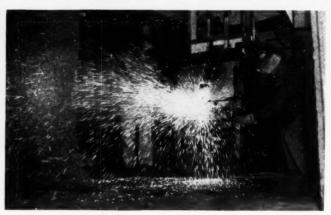
Advanced design of the new plant has afforded greater operating flexibility. Even during this extreme pressure for volume production, specifications for performance and quality of each product are readily maintained. Research data are being accumulated to aid in developing new and improved Dicalite products for future industrial use.

# DICALITE DIVISION GREAT LAKES CARBON CORPORATION





MELTING: Silica and alumina are melted at 3,300 deg. F. in this pilot furnace.



BLOWING: High-velocity air blows the melt into fibers, shown experimentally here.

# Ceramic Melt Blown Into Fibers

Carborundum melts silica and alumina in an electric furnace, uses air blast to make a vitreous ceramic fiber. New furnace will soon turn out 14 tons daily.

Something new has been added in the way of ceramic products: A vitreous, synthetic aluminum silicate fiber with unusual thermal and electrical properties.

The new ceramic fiber, under development at Carborundum Co. for about two years, is now being commercialized under the trademark "Fiberfrax." Pilot-plant output at Niagara Falls has been at the rate of about one ton per day. Most of this has been used in development work on

high-temperature insulation, dielectric materials, filtering agents and fireresistant papers (see p. 198).

►Output Goes Up—Yet industrial uses for Fiberfrax now look rosy enough for Carborundum to go ahead and lay plans for upping its output.

Right now, a semi-commercial unit is going up at Niagara Falls, N. Y. It will be in operation by mid-November; capacity will be about 14 tons daily on a three-shift basis.

Carborundum is also making plans

for a new commercial plant that'll most likely be at Falconer, N. Y., some 60 miles south of Buffalo. This unit will probably get under way by early 1954. Planned capacity is 45-50 tons daily on a three-shift basis. It will cost close to \$500,000 (mostly for furnaces and transformers).

Besides, the price of Fiberfrax—now at \$1.00 per lb.—will certainly go down, thus stimulating new uses. Once the large commercial plant goes on stream, the price will probably be slashed to around 50 c. per lb.

Carborundum's people don't yet dare estimate the market potential for their new fiber. But they are convinced that they "have something big"—and point to the present markets for glass wool, glass fibers, asbestos and high-temperature insulating brick. Fiberfrax will be competitive with many of the uses for these materials.

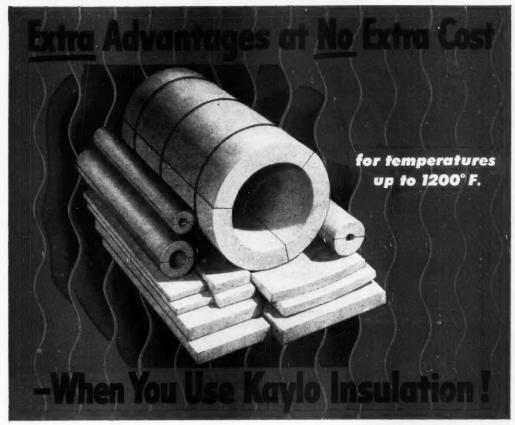
On Three Counts—Chemical engineers can chalk up Carborundum's development of this new ceramic fiber as important on three counts:

• It gives them a new type of industrial fiber with unusual properties —properties that will give rise to many uses throughout the chemical process industries (see p. 198).

• It will eventually stimulate improvements in the design of electrothermal furnaces, especially the batch, arc-resistance type. Few design changes have been made in these furnaces for decades; now Carborundum expects to develop a continuous arc-resistance furnace for its commercial Fiberfrax plant.

• It illustrates-and strengthensthe technological quickening that's gaining strength throughout the ceramics industry. For the trend on the horizon is now evident: Within the next decade, the ceramics industry will open up vast new fields through improved technology and better products. ► Melting-Raw materials for Fiberfrax are high-purity silica as quartzite and alumina made by the Bayer process. These are used in the proportions of about 50 percent SiO2 and 50 percent Al2Oa. A higher ratio of Al2O3 cuts down the yield of fibers, increases the formation of pellets in the fiberblowing operation.

These materials are charged to an are-resistance electric furnace of the open, vertical pot type. Bottom of the furnace's steel shell is lined with carbon blocks; the remainder of the shell



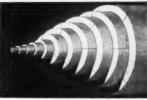
For example, Kaylo Heat Insulation reduces inventory requirements because:

- 1. Wide effective temperature range -up to 1200° F.—eliminates the need for combination coverings in nearly all operating conditions.
- 2. Simplified Dimensional Standards allow nesting.
- 3. Unmatched selection of shapes and sizes reduces the number of pieces required per job.

Kaylo Heat Insulation reduces installation costs because:

- 4. The material is lightweight, strong and easily handled.
- 5. It is easy to cut and fit with standard tools.

Kaylo Heat Insulation is a hydrous calcium silicate—the heat-saving material that is revolutionizing insulation practice with its outstanding combination of advantages. Get all of the facts now.



Simplified Dimensional Standards mean that O. D.'s of insulation correspond to O. D.'s of standard pipes, assuring proper fit for nesting, when necessary. With this system of snug nesting, Kaylo Heat Insulation assures fits for all operating conditions, requires less items-reduces inventory stocks.



WRITE FOR FREE BOOK — "Kaylo Heat Insulation." Address: Dept. N-263, Owens-Illinois Glass Company, Kaylo Division, Toledo 1, Ohio.



... pioneered by OWENS ILLINOIS Glass Company

MAIN OFFICE: TOLEDO 1, OHIO - KAYLO SALES OFFICES: ATLANTA . BOSTON . CHICAGO . CINCINNATI . CLEVELAND . DETROIT HOUSTON . MINNEAPOLIS . NEW YORK . OKLAHOMA CITY . PHILADELPHIA . PITTSBURGH . ST. LOUIS . WASHINGTON

# INFRARED PROVIDES ACCURATE AUTOMATIC END POINT ANALYSIS

ACETYLENE -

Acrylonitrile Acetaldehyde Acetic Acid Vinyl Chloride

ETHYLENE

Ethylene Glycol Ethylene Oxide Ethanol Ethylene Dichloride

with the

# PROCESS CONTROLS

# PLANT STREAM ANALYZER

- The decisive factor in the economic success of a process is product quality and yield.
- End-point analysis for concentration variations is a reliable index of product quality and yield.
- Through end-point control, the results of such analyses can be used to provide automatic and continuous correction of the process variables.
- For these reasons, end-point analysis and its control application have become of major significance to the process engineer.
- The PROCESS CONTROLS Plant Stream Analyzer is specifically engineered for end-point analysis and control applications.

# PROCESS CONTROLS

a division of Baird Associates, Inc.

33 UNIVERSITY ROAD CAMBRIDGE 38, MASSACHUSETTS

News, cont. . .

is unlined since the frozen melt forms its own insulating, protective lining. The shell is cooled on the outside with a small spray of water.

The charge is heated to about 3,300 deg. F. As it melts, the two carbon electrodes are raised and more charge fed in. This is kept up until the furnace is full and ready to be tapped.

Carborundum's present method for making aluminum silicate melt for its fiber is a batch proposition; the furnace design is similar to that for making fused alumina. Company engineers, however, expect to come up with a furnace that can be charged and tapped continuously. Under development now, this new-type continuous furnace will be used in Carborundum's commercial Fiberfrax plant.

A small amount of modifying agents—usually about 1.0 percent boric acid or less than 0.5 percent soda ash—are added to the melt to lower its viscosity. This is important, for it later increases the yield of fibers at the expense of pellets. Viscosity, rather than temperature, is the critical factor in the melting operation.

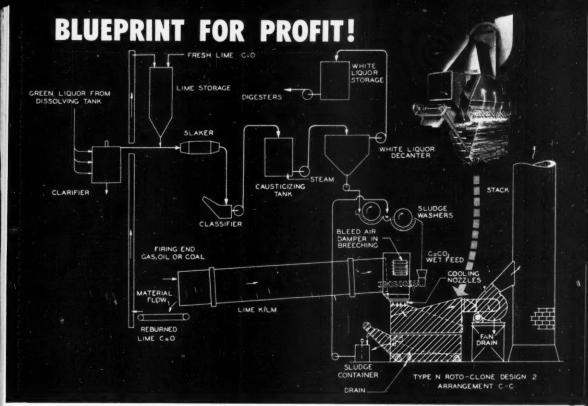
About 10 percent of the SiO<sub>2</sub> charge is lost through volatilization. Energy needs of the furnacing operation are 1.5-2.0 kwh. per lb. of products. Carborundum engineers say that this will be appreciably lower in their commercial plant.

▶ Blowing—Actual formation of the fibers takes place when the melt is tapped as a thin stream of molten aluminum silicate. Then a blast of air from a 100-hp. compressor hits it, blows the molten material into fibers of random length and diameter.

Air at 125 psi. or steam at 100 psi. can be used; Carborundum hasn't decided yet which to use in its commercial plant. There are slight differences in the properties of fibers blown with air or steam.

This blowing of the melt is actually a ticklish job. Since large volumes of high-velocity air (the velocity may approach 50,000 ft. per min.) are used, the "piling up" of excess air in the blowing room often poses a problem.

Another problem is how to increase the yield of fibers. The blast of air, hitting the stream of molten material, breaks it up into small fragments. These fly through the air to form "streamers" of fibers as they solidify. If the blowing is not done just right, they will tend to solidify into small



Type N Roto-Clone Arrangement C-cutaway shows automatic sludge ejector and distinctive water curtain created by air flow.

# Type N Roto-Clone Converts Stack Gas Nuisance into Cold Cash and Goodwill

Lime kiln stack gas losses cost kraft pulp mills plenty. Up to 156 pounds of lime per ton of pulp will be lost up the stack with the resulting dust causing both expensive equipment repairs and neighborhood nuisances.

With the installation of the Type N Roto-Clone\* dust-control system, as shown above, lime losses have been reduced to 15 pounds per ton. What's more, the dust threat to costly mill motors has been eliminated along with neighborhood complaints. This is just one example of many in the chemical, rock products and mining industries where Roto-Clone's high cleaning efficiency has both eliminated a dust nuisance and salvaged valuable materials. Exhausting kilns, dryers, roasters and coolers—all involving heavy loads of fine dust at high temper-

atures—are the kind of tough jobs welcomed by the Type N Roto-Clone.

Reason for the Type N's success? It's a hydro-static precipitator. Combined action of centrifugal force and a thorough intermixing of water and dust-laden air result in high cleaning efficiency. It is unaffected by high temperatures, can't clog and the dust is collected as sludge for easy reprocessing or disposal.

Get the complete Type N Roto-Clone story now! See your nearest AAF representative or write for Bulletin No. 277. Convert that dust nuisance into goodwill—and dollars.

\*\*ROTO-CLONE is the trade-mark (Reg. U. S. Pat. Off.) of the American Air Filter Company, Inc., for various dust collectors of the dynamic precipitator and hydro-static precipitator types.



American Air Filter

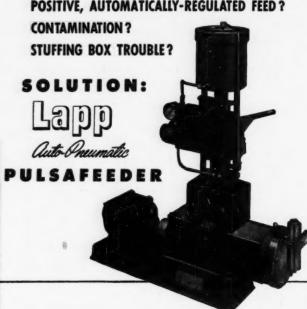
326 Central Avenue, Louisville 8, Kentucky

American Air Filter of Canada, Ltd., Montreal, P. Q.

Pacific Division Office, San Francisco, California



PUMPING CORROSIVE CHEMICALS?
POSITIVE, AUTOMATICALLY-REGULATED FEED?



Chemicals successfully being handled include gum and sludge inhibitors, metal deactivators, anti-oxidants, dyes and stabilizers. Alse those for boiler water or processing water treatment—concentrated sulphuric acid, sodium sulphite, filter aid slurries, liquid caustic. For the Lapp Pulsafeeder is the positive-displacement pump for controlled-volume pumping of liquids which depends on no stuffing box or running seal—avoids contamination by an hydraulically-balanced diaphragm which isolates pumping mechanism from chemical being handled. Pumps against pressures up to 2,000 lbs., at constant pumping speed—variable flow results from variation only in piston-stroke length. Auto-Pneumatic control uses instrument air pressure responding to any instrument-measurable variable.

GOT A SPECIAL PROBLEM? Every month we hear about applications to which the Lapp Pulsafeeder is the long-awaited answer. A newly-issued bulletin, No. 300, will tell you about our pump and its characteristics, with typical applications and flow charts. A Pulsafeeder Inquiry Data Sheet, on which you can outline your processing requirement, will bring an engineering recommendation. Write us today, Lapp Insulator Co., Inc., Process Equipment Division, \$45 Maple Street, Le Roy, N. Y.



News, cont. . .

pellets instead of streaming into fibers. These pellets are often of micron size.

Factors that evidently affect the ratio of fibers to pellets are the viscosity of the melt, the volume and velocity of air, the method of contacting the air with the molten stream, rate of chilling and distance traveled by the "streaming" particles. Coalescence of particles may also be a factor.

So far, Carborundum has succeeded in getting a fiber yield of around 50 percent on a weight basis. This figure, however, is steadily being increased.

however, is steadily being increased.

Pellet Problems—For many uses of Fiberfrax, these small pellets make little difference and don't have to be taken out. But they do represent a loss in fiber yield, so Carborundum's engineers are tackling the tough job of removing them. Once removed, they can be charged back to the furnace for remelting. It's also likely that Carborundum's development people will uncover markets for the pellets themselves.

Several methods for removing the pellets are being tried out:

• Wetting: If the fiber mass is floated on water, the fibers will float and most of the pellets will settle. This has the drawback of putting two new steps into the operation—floation and drying of both products.

• Air settling: Because of the differences in their densities, fibers and pellets have different settling rates in air. The small pellets normally travel farther in the blowing operation (fibers are formed from the tails or "streamers" of the shooting pellets). But it's a tough job to reduce this differential settling rate to a precise technique.

 Mechanical handling: Even a small amount of handling will cause the pellet heads to break off and separate from the fibers. This, too, would bring up many problems in large-scale operations.

It isn't obvious yet which separation method will pan out to be the best. But Carborundum's engineers are confident they will lick the problem, probably by a combination of methods. And for many grades of the product, the pellets won't have to be removed.

Another big problem is the sheer job of collecting and handling large volumes of the fluffy, fibrous material. As blown, the fiber weighs about 2 lb. per cu. ft. Thus output from the

projected commercial plant could amount to close to 50,000 cu. ft. daily. Special equipment and techniques will have to be used, the Carborundum people say.

Fiber Properties—The fibers as blown are up to 3 in. long with an average diameter of about 4 microns. They are not crystalline, but have a smooth vitreous surface. The fluffy, white mass is made up of random arrangements of these fine fibers.

Fiberfrax can resist temperatures up to 2,300 deg. F. without loss of properties; it does not soften at temperatures approaching 3,000 deg. F. It is resistant to corrosion by most chemicals.

Because of the fineness of the fibers and their random arrangement, Fiber-frax is a super-filter for gases and liquids. It will filter out practically 100 percent of the solid particles down to 0.3 micron—which takes in most bacteria. Filters can be sterilized by calcination.

At present, Fiberfrax is available only in bulk form. Work is under way to produce it in felted blanket rolls, bonded batts, tape and paper-like forms with a wide range of thicknesses and characteristics. It is not yet available in spun or woven form, but mixtures with other fibers permit carding and spinning.

# Sterling Will Boost Grinding Capacity at Sugar Refinery

Sterling Sugars, Inc., is expanding its Franklin, La., plant to give it a grinding capacity of 400,000 tons of cane in a 70-day season. The expansion, according to President Whitaker Lonsdale, will give Sterling the largest single grinding and refining combination in the United States.

Three quarters of a million dollars will be spent on expansion during 1953 and over a million dollars more will be expended on the project by 1955.

Sterling plans call for building its 6½-ft. tandem to a high-speed 18-roll mill and crusher. It will be completely turbine-driven with new high-speed gearing. In addition, the 6-ft. tandem will be maintained in top condition so that it can be cut in during the season's peak or in an emergency. Warehousing will be built to store 350,000 bags of refined sugar and 8,000 tons of raw sugar.

To keep the mill operating without interruption, the expansion has been





News, cont. . .

divided into a series of annual projects.

Two important needs will be met by the expansion, according to Lonsdale. First, farmers in the area surrounding Franklin will be provided with a modern plant and refinery where their crops can be harvested. Second, the company gets one of the most modern and efficient raw sugar-refinery combinations in the U. S.

# Phillips Expanding Its Ammonium Sulphate Plant

Expansion of the Port Adams ammonium sulphate plant of Phillips Chemical Co. near Pasadena, Tex., is just getting started. Capacity will be boosted from 760 to 1,000 tons per day. Construction is expected to be completed late in 1953.

Initial operation of the ammonia plant now being built at the Port Adams plant is expected at about the same time.

Additional sulphuric acid requirements will be supplied from the company's West Texas recovery plants. Plans to use gypsum for production of ammonium sulphate apparently have been shelved at least temporarily.

### CONVENTION CALENDAR

Chemical Market Research Association, Mont Tremblanc Lodge, Quebec, Canada, September 25-26.

American Oil Chemists Society, fall meeting, Netherland-Plaza Hotel, Cincinnati, October 20-22.

Association of Consulting Chemists & Chemical Engineers, annual symposium, Belmont Plaza Hotel, New York, October 28.

Salesmen's Association of the American Chemical Industry, chemical sales clinic, Commodore Hotel, October 28.

American Association of Textile Chemists & Colorists, annual meeting, Statler Hotel, Boston, November 6-8.

American Council of Commercial Laboratories, annual meeting, Schenley Hotel, Pittsburgh, Pa., November 12-14.

National Paint, Varnish & Lacquer Association, annual convention, Palmer House, Chicago, November 17-19.

Federation of Paint & Varnish Production Clubs, annual meeting, Palmer House, Chicago, November 20-22.

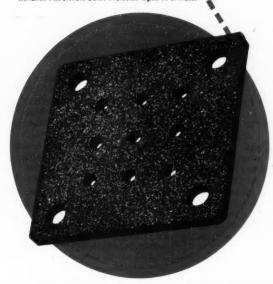
Manufacturing Chemists' Association, semi-annual meeting and winter conference, Statler Hotel, New York, November 25.



# In making a better motor . . . IT'S THE LITTLE THINGS THAT COUNT, too!

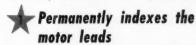


Reliance PRECISION-BUILT Protected Open A-c. Motor



Here is one of the many extras which prove that "All Motors are NOT Alike."

This synthetic-rubber gasket . . .



Prevents leads from rubbing against metal parts

Prevents water from entering motor at conduit box

Write for more evidence of the many ways in which Reliance Precision-Built Motors are made better to deliver dependable power longer. Bulletin B-2101 provides selection data for a-c. motors from 3/4 to 300 horsepower.

# RELIANCE ELECTRIC AND ENGINEERING CO.

1063 Ivanhoe Road, Cleveland 10, Ohio

Sales Representatives in Principal Cities

TOM WARE'S decision set the project in motion. He's IMC engineering v.p.



VIBROFLOAT is ready for a compaction. It's suspended by the crane.



CRATER is formed after Vibrator had been inserted to 8 ft., then pulled clear.

# Built Upon the Sand

International Minerals' new phosphate plant, supported on compacted sand, proves the worth of Vibroflotation for heavy industrial construction.

Many large areas of the world, hitherto unsuited for heavy construction because of poor load-bearing qualities of the soil, may become prime industrial sites through use of a new soil compaction process. Principle of the process, known as Vibroflotation, is the subsurface compaction of wet sand by mechanical vibration.

International Minerals and Chemical Corp. is pioneering the use of this process for industrial construction in the U.S. Its new phosphate plant near Mulberry, Fla., about eight miles from Bartow, is being built on sand compacted by Vibroflotation. Callix E. Miller, Jr., field construction engineer, estimates that the company has saved approximately \$250,000 over the use of piling. Compaction costs are running \$1.50 per sq. ft. whereas piling in the same are would cost in the neighborhood of \$12 per sq. ft.

▶ Vibration Plus Water—Vibroflotation can be described simply as shaking and pushing sand into a tighter mass in depth, obtaining the greatest possible bulk density. The sand grains are soaked with water, which acts as a lubricant. Where a loose sand could support only 2,000 lb. per sq. ft., the compacted sand can support 6,000 to 8,000 lb. per sq. ft.

The operation is done by a tubular instrument about 15 in. O.D. and 25 ft. long called the Vibrofloat. It contains an electric motor and an eccentric or unbalanced weight in its 6-ft. lower or working section. This vibrator is attached to a follow-up pipe about 12 in. in diameter housing water and electric lines and extending the remaining 19 ft. (or any distance required for the contemplated depth of soil penetration). The whole is suspended from a crane and is guided by vertical wooden leads.

Two of these machines, one built by Baldwin Locomotive Works, the other by a local contractor, were used on the Mulberry job. Each weighs about 5,000 lb. and generates a 10-ton centrifugal force when the eccentric is revolving at full speed.

The eccentric vibrates at 1,800 rpm.

-close to the natural frequency beat of the earth. In-phase vibration produces more effective shocks than if the device worked out of phase with the natural earth resonance.

► How It Works—In operation the vibrator, positioned by its crane, is allowed to obtain full speed above the spot to be compacted. A water jet at its tip is then opened, forming a pool and saturated mass of soil.

With the jet still playing, the unit sinks of its own weight into this saturated sand, while its vibration and the water being forced upward around it create a momentary quick-sand condition. The Vibrofloat rapidly disappears—while driving sand by centrifugal force out of its path into the walls of the funnel-shaped opening around it.

After the machine reaches the desired depth (12 to 16 ft. in the Mulberry job) it is halted. Water flow is transferred from the bottom jet to vents at the top of the vibrator, from where it runs downward along the side of the machine. This carries down additional sand for compaction into the sand wall against which the Vibrofloat is now pounding.

A 3-ft. diameter crater forms at the top of the hole as sand sucks downward along the vibrating cylinder. Workmen keep shoveling fresh sand into the crater. As sand packs tighter in the hole, current drawn by the vibrator motor increases. The cut-off point is determined by an upper amperage limit.

The machine is then lifted 1 ft. and pounds away some more, and so on in 1-ft. stages until up to the desired foundation level or to grade.

The operation takes 15 to 20 min. for a single compaction. In that period an average of 2½ cu. yd. of sand is added to the soil at each compaction. This means that 67½ cu. ft. of sand has been poured into about 13 cu. ft. of space temporarily occupied by the Vibrofloat.

The compacted columns of sand extend for a radius of about 5 ft. around the point of compaction. For safety

factor, the columns are overlapped by spacing them on 8-ft. centers.

▶ Stands Up Under Vibration—One of the big advantages of Vibroflotation, it is claimed, is ability of the compacted soil to withstand mechanical vibration of heavy machinery. For the International Minerals plant, there was serious question as to the ability of piling to provide a good enough support under vibrating loads.

The Vibroflotation process was invented by Sergey Steuerman in Germany during the 1930's. By the time Steuerman came to the U.S. in 1939, he had patents under his belt from 20 countries. Although some successful tests were run during the 1940's, no one seemed interested in large-scale application. That is, until last year when International Minerals started surveying for its new \$12-million

This particular location was selected for a very practical reason—proximity to raw material supply. But when Rust Engineering Co. (Pittsburgh and Birmingham) was awarded the design-construction contract, its engineers recognized the critical foundation problems involved. In the same general district, Rust had previously driven H-piles for 104 ft. without

meeting sufficient resistance to support even nominal loads.

Florida plant.

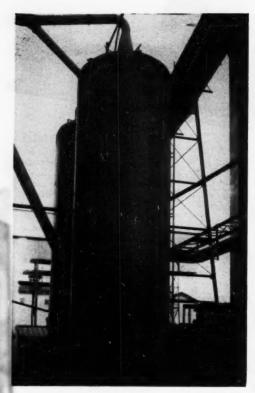
Rust's engineers, who had previously been investigating the potentialities of Vibroflotation, recommended compaction by this method, rather than attempting to use piling. Thomas M. Ware, engineering vice president of International Minerals, gave this recommendation his firm support.

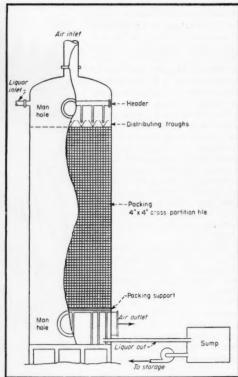
Ware's decision was based on the considered opinion of some top soil authorities. Dr. Elio D'Appolonia (Carnegie Tech) made a special study and came out for Vibroflotation. His opinion was endorsed by two other experts, Philip Rutledge (Northwestern) and B. K. Hough (Cornell).

The main job of compaction was finished on March 19 of this year. It was the 160th day from the start of the work, and 3,350 compactions had been made in that period.

After six months the phosphate storage building, one of the first to be erected, has experienced no measurable settlement. Advance estimates had allowed for a maximum settlement on the order of 1 in. under major structures during and after building. Present indications no longer anticipate even this low figure.







# **Tower Oxidizes Odors Away**

Kraft pulp mill alleviates the odor problem of escaping hydrogen sulphide with an oxidizing tower—and saves 1,000 tons of sulphur per year.

At the Springfield, Ore., mill of the Weyerhaeuser Timber Co. they've engineered out the offensive odors that had been escaping from pulping ("cooking") liquors—something that kraft mill operators have been trying to do for a long time. And they've saved a good deal of sulphur to boot.

They do it by oxidizing (in a large tower) the volatile and odorous sulphides in spent cooking liquor to more stable thiosulphates.

Almost two years ago, the engineers at Springfield put the full-sized tower (see cut) into operation; it has worked successfully ever since.

But here's the story as it was told to us by Weyerhaeuser's Joseph C. Brown, technical director of the Springfield Mill and by H. W. Bialkowsky, research director, and Gerritt G. Dehaas, research chemist, both of the Pulp Division of the company.

► Whence the Odor—In manufacturing wood pulp by the sulphate (kraft) process, a mixture of sodium hydroxide and sodium sulphate is the active pulping agent. (It's the sodium sulphide that leads to the formation of noisome, volatile sulphur compounds; these are released from various points in the liquor recovery system.)

During normal operations, the strength and volume of the cooking liquor is kept up by adding makeup sodium sulphate (salt cake) to the spent cooking liquor. This is added in the recovery operation after evaporation and just prior to burning in the recovery furnace. The furnace main-

tains reducing conditions in the char bed and the sodium sulphate is reduced to sulphide.

However, in a well-operated plant, losses of sodium compounds may be so low that the amount of makeup salt cake needed to maintain liquor inventory may not be enough to maintain "sulphidity" (ratio of sodium sulphide to alkali; 15-25 percent is desirable). When this happens, many mills add elemental sulphur to the system. The recovery furnace reduces the sulphur to sodium sulphide, thus replacing the volatilized sulphur compounds that have been lost.

► Simple Air Oxidation—Knowing that these volatile sulphur compounds (mostly H<sub>s</sub>S) could be oxidized to more stable compounds by bubbling air into the liquor, Weyerhaeuser researchers set out to learn just how much air was needed. They also wanted to find out if they could skirt the problem of foaming of the liquor, a complication that previous researchers had run into. (Continued)



# CHIKSAN ADDS SAFETY and SPEED TO LOADING OF TANK CAR AND TRUCK

It takes speed, safety and kid-glove handling to keep up the massive flow of liquefied petro-leum gas at Standard Oil Com-pany of California's El Segundo plant.

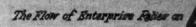
Chiksan provides the necessary liquid-tight, gas-tight unions, the characteristic flexibility of otion to keep the touchy Bucane flowing at a swift, even pace with safety to workers, plant and community — with profit to the company.

No less than eight Chiksan Ball-Bearing Swivel Joints are needed for each loading in-stallation to keep the gas moving into tank and truck—to provide the essential carry-off of the highly explosive vapors. And with Chikaan on the job, metal of relative low porosity takes the place of more porous and less and rubber.

Standard Oil Company of California's El Segundo installations are typical of indus-try's reliance on Chiksan Ball-Bearing Swivel Joints around the world to speed the flow of enterprise — to promote production and de-fense—to increase safety—to protect profits.

over liquid or gas must flow he industry—
eve hydraulic systems can add efficiency and
op—Chiksan Ball-Bearing Serivel Joinst are
job. If more faxibility—greater stamina—
life and added economy are by interest to
bilizant's Research and Devolopment Division
by you find a bester, suffer scay.

With counterbalanced Chiksan loading racks, one man can quickly and easily make connections to tank cars.



Representatives in Principal Cities

CHIKSAN COMPANY . BREA, CALIFORNIA . Chicago 28, Illinois . Newsrk 2, New Jersey Well Equipment Mfg. Corp. (Division), Houston 1, Texas : Chiksun Export Company (Subsidiary), Been, California; Nawark 2, H. J.

# TAG Simplified AUTOMATIC CONTROLLERS

# -for Temperatures and Pressures

# SELF OPERATING TEMPERATURE OR PRESSURE CONTROLLERS



Self-contained and self operating, requiring no outside power supply . . . for hot water storage heaters and tanks, canning retorts, exhaust boxes, scouring bowls, etc.

# STEAM OPERATED TEMPERATURE OR PRESSURE CONTROLLERS



Operate on upstream steam supply, requiring no air or electricity. Controls temperature or pressure. Gives full throttling action – recommended wherever use of air operated type is inconvenient.

### 'FAULTLESS" TEMPERATURE CONTROLLER

A superior and easily installed air-operated instrument of the expansion stem type. Operates diaphragm on 18 p.s.i. air



### "SIMPLEX" PRESSURE CONTROLLER

Provides exact throttling type regulation—widely used as reducing valve, back pressure regulator, pump governor, safety



# #42 TEMPERATURE OR PRESSURE CONTROLLERS



Simple, compact, highly accurate standard throughout industry for years for many automatic control applications. Operates on 18 p.s.i. air supply.

### AUTOMATIC TIME CONTROLLER



Precise timing device for automatically shutting off heat supply, etc. at pre-set time. Widely used in conjunction with Tag Temperature or Pressure Control-





News, cont. . .

After exhaustive laboratory experiments they found that the best bet seemed to be the use of some form of tower to carry out the oxidation.

The laboratory results were engineered through the pilot plant and in October, 1950, the full-sized tower was put on stream.

The tower is designed to handle 300 gal. of black liquor per minute, with an incoming sulphide concentration of 3 g. per 1. The drawing (above) shows its details. Dimensions are: 10 ft. in diameter, 30 ft. high. It's packed with 22 ft. of 4 in. cross partition rings, giving an effective surface of 50,000 sq. ft.

The black liquor is pumped from a storage tank to a distributing arrangement on the tile at the top of the tower. Air is forced into the tower at the top and passes out a vent line from a sump at the bottom. The black liquor overflows the sump, into a secondary sump and from there it is returned to a second storage tank.

They use about 10 cu. ft. of air per minute for each gallon per minute of liquor flow. They ran into no serious foaming troubles and no hydrogen sulphide was found in the air leaving the oxidation tower.

Although the chemical reactions in the tower are complex, the chief reaction seems to be the conversion of sodium sulphide in the spent cooking liquor (or black liquor) to sodium thiosulphate or some other stable sulphur compound. Actually, a water solution of sodium sulphide is relatively stable to air oxidation. But the black liquor is rich in organic compounds and it's believed that this material acts as a catalyst to promote the reaction between sodium sulphide and oxygen.

The sulphide is completely oxidized when the tower load does not exceed 0.67 lb. sulphide ion (expressed as sulphur) per 10,000 sq. ft. of packing surface per minute. Air flows are 4-6 cu. ft. per gallon of liquor for normal concentrations of sulphide.

Liquor distribution in the tower permit good wetting with a minimum of splashing. Liquor and air are passed through the tower in the same direction and flows are adjusted to keep regurgitation down. Treated liquor is collected in a sump at the bottom of the tower, overflows to a secondary sump. The levels in these sumps are carefully adjusted so that the flow of the liquid breaks and stabilizes the foam at the liquid surface. If these liquid levels are not properly balanced very large amounts of foam can be produced.

Before installing the oxidation tower system, operators had to add up to 20 lb. of sulphur per ton of pulp in order to maintain a sulphidity of 14-16 percent. The company estimates that at the present level of production these additions would amount to nearly 1,000 tons per year of critical brimstone. With the tower operating, they've stopped adding sulphur and the sulphidity of the liquor has increased to 21-25 percent with substantially the same amount of makeup salt cake used (about 100 lb. per ton of pulp).

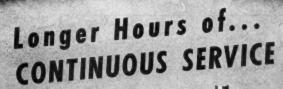
Joseph C. Brown points out that the principle of liquor oxidation is readily adaptable to any kraft black liquor of comparable sulphidity. Weyerhaeuser oxidizes the liquor from Douglas fir which is their primary wood supply.

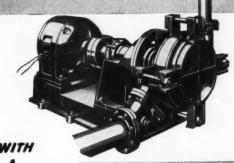
The company points out that while generation of H<sub>s</sub>S in the evaporating process has virtually been eliminated, the problem is not entirely erased. Hydrogen sulphide is still generated in the recovery furnace and volatile organic sulphur compounds are released in venting the digesters and the multiple-effect vacuum evaporators.

# Phillips Building Plant To Make Triple Super

Phillips Chemical Co. has decided to go ahead with the building of a triple superphosphate plant at its Port Adams plant near Pasadena, Tex. The new plant, to be adjacent to the present ammonium sulphate unit, will have a capacity of 405 tons per day.

Triple superphosphate will be produced from phosphate rock shipped from mines in Florida to Houston. Sulphuric acid will be made from sulphur produced in the company's sulphur plants in West Texas from hydrogen sulphide gas.





MORRIS TYPE R
SLURRY PUMP

The 4 features of the Morris Type R Slurry Pump mean low-cost operation . . . minimum "lay up" time.

- Easily dismantled—Impeller and shaft sleeve are renewable without disturbing piping or bearings.
  - Four easy-to-get-at outside clamping bolts hold impeller, liner, shell and cover firmly in place.
- Simpler design—The Morris Type R Slurry Pump has no troublesome internal bolts or studs.
  - Gland is under suction pressure only. Hence, it's less vulnerable to abrasive solids . . . less subject to packing troubles.
  - Four adjusting screws close the worn clearances on the suction side of impeller. This adjustment moves the entire rotating assembly as a unit.
- 3 Corrosion-abrasion resistant—You may have the Morris Type R with its moving parts in any of various metal alloys, depending upon the kind of slurry you handle. Parts are quickly interchanged.
- Shell is interchangeable for right or left-hand rotation—
   Permits 72 different combinations of suction and discharge nozzles.
- FREE TECHNICAL SERVICE—Morris Engineers have been building pumps for more than 80 years. They will be glad to recommend the pump best suited to your needs. No charge or obligation.

FOR LESS TROUBLE...

LESS MAINTENANCE...

LESS LAY-UP TIME ...

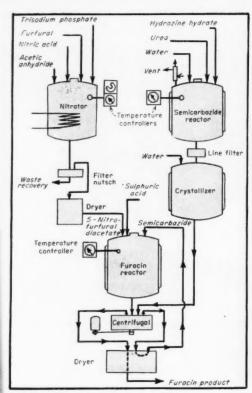
and LONGER HOURS OF

Specify
MORRIS TYPE R
SLURRY PUMP

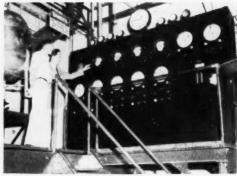
MORRIS MACHINE WORKS

Baidwinsville, N. Y. Branch Offices in Principal Cities

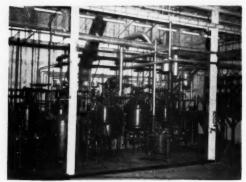




THREE STEP synthesis; all three steps highly controlled.



CONTROL panel might be expected to oversee a large plant, but . . .



DRUG unit is small. Graphic panel (rt.) puts it in perspective.

# Smart Engineering on a Small Scale

Small chemical plants can be well engineered too. Take the problem of nitrating furfural to produce a new drug. Norwich Pharmacal solved it with automatic control.

Deft engineering in the unit process of nitration is the feature of Norwich Pharmacal's new plant at Norwich, N. Y. to produce nitrofurans, versatile new drugs for human and veterinary use.

The \$140,000 plant, which began operating early this year, is designed to produce 240,000 lb. of Furacin, a crystalline solid with a wide anti-bacterial spectrum, and the most important member of the nitrofuran series. Norwich is sole producer of these drugs; Furacin, a registered trade name.

This product (chemically it's 5nitro-furfural semicarbazone) is made by reacting 5-nitro-furfural diacetate and "semicarbazide." The diacetate is made by nitrating furfural (1.5 lb. furfural per lb. of final product) in acetic anhydride and concentrated nitric acid. The "semicarbazide" is made by reacting urea with hydrazine hydrate.

▶ Engineering Is Tricky—The heart of the process—nitration of furfural—is a tough problem because of the tremendous heat generated and the fact that this heat—unless controlled—raises the reaction temperature, cuts down the yield. At Norwich it works this way:

First, the nitric acid is added to acetic anhydride to form an agent suitable for nitrating the furfural, which is added next. In this step, the

physical action of bringing the materials together is important—the faster they're added, the greater the yield within certain limits. Large heat releases (60,000 Btu. removed from about 30 gal. of mixture) necessitate extremely large cooling capacity; this, in turn, because of volume-surface relationships, limits the practical size of the nitrators to 100-gal. units.

Nitrator design was complicated still more by the narrow agitation range set by the reaction. Some agitation was necessary to prevent local overheating; too much agitation introduced air into the mixture. Both air and overheating resulted in low yields.

Following the addition step, the reaction mixture is aged in order to complete the formation of the nitration intermediate. The intermediate is then converted to 5-nitro diacetate by heating in a water solution buffered



For close to 30 years, Glycerine has insured a uniform blend of flavor and prevented dried out edges in every Chase "Pep-R-Mint." Hard and smooth to the touch . . . each lozenge is mellow and creamy to the tastel

### FULLY ACCEPTED ... FULLY AVAILABLE IN ALL GRADES!

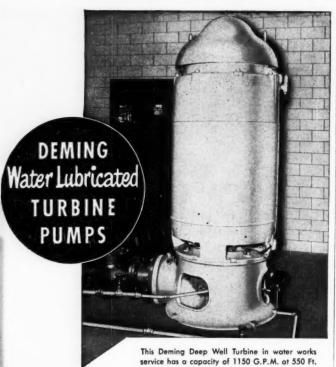
In the food processing field, Glycerine's major contribution has been in preserving freshness and maintaining palatability. It is completely acceptable as to taste and odor.

In artificial flavors, extracts, oils and essence, it assures an even and thorough dispersion of both flavoring and coloring materials. It may serve as a sweetener, solvent or blending agent. And recent research has indicated that it will lengthen the shelf life of butter creams and similar perishables by suppressing fatty acid formation.

Only Glycerine can supply this remarkable range of advantages—plus the assurance of physiological safety. Its use has been accepted by medical associations and government agencies . . . and production is meeting the demands of volume users. Its applications? Write for a copy of "Why Glycerine for Foods?"

# GLYCERINE PRODUCERS' ASSOCIATION

295 Madison Avenue, New York 17, N. Y.



adaptable to a wide range of applications

There are three principal components in Deming Vertical Turbine pumps. These are the Drive Assembly, the Column and Shaft Assembly, and the Bowl Assembly.

Those three principal components are manufactured in a wide range of standard sizes for quick assembly into almost unlimited combinations to meet specific conditions.

Unit drive head is furnished where electric power is available. Auxiliary drives are available to meet various requirements.

DEMING annation:

> Write for Bulletin No. 4700 which gives you detailed information about Deming Vertical Turbine Pumps.

Pumps are designed for wells 4" to 16" or larger in a full range of capacities from 15 to over 3500 G.P.M.

total head with 200 H.P. motor.

For dependable, low cost operation and maintenance in water works pumping service, Specify Deming Vertical Turbine Pumps.

THE DEMING COMPANY . 525 Broadway . Salem. Ohio

Deming
DEPENDABLE PUMPS

News, cont. . .

by tribasic sodium phospnate. The product crystallizes and can be filtered directly on cooling.

▶ Nitration All Automatic—Licking these problems was largely a matter of control. Norwich engineers, who had been working with the pilot plant since 1944, decided to make the nitration operations completely automatic.

Each nitrator is equipped with a separate controller containing two distinct control systems. The first control unit keeps the temperature constant during the addition of the nitric acid and then the furfural by regulating the flow of these reacting chemicals while simultaneously regulating the flow of cooling water in the coils.

When the additions are completed, an air valve shifts operation to the second control unit which operates steam and water valves.

A time cycle cam then guides the temperature of the reaction mixture first through the aging period, then the conversion period and lastly, cools it in preparation for filtration.

One operator can handle several nitrators with these controls. Operation of the entire process on a 24-hr. basis requires four operators per 8-hr. shift

Next step in the process is preparation of the "semicarbazide": raw materials are hydrazine and urea. These are first heated for several hours and then (after dilution and filtration to get rid of byproducts) the desired material is precipitated.

Last step, preparation of the Furacin itself, is done in a Pfaudler glasslined reactor. First, 5-nitro-furfural diacetate is hydrolyzed to nitro-furfural which then is free to react with the "semicarbazide." The final product, 5-nitro-furfural semicarbazone, precipitates and is filtered off.

Like Antibiotics—Yellow crystals of the drug, when dissolved in appropriate vehicles (usual range of concentration: 0.02-0.2 percent) are made into ethical pharmaceuticals to treat—or prevent—surface bacterial infections as of wounds, burns, infections of the skin, eye and middle ear. These are produced by Eaton Laboratories, Inc., the professional subsidiary of Norwich Pharmacal Co. Another important outlet for the drug is veterinary medicine, where it's used to treat or prevent some of the most prevalent and ravishing diseases of animals and poultry. For some veterinary uses, Furacin goes into the feed at concentrations of about 0.006 percent.

Antimicrobial action of the nitrofurans is similar to the antibiotics in that they disrupt enzymatic metabolism of the bacterial cell with little or no harm to mammalian tissue. In addition, bacteria don't develop resistance to the drug—one of the chief disadvantages of the antibiotics.

Nitrofurans are simple in chemical structure so its relatively easy to "tailor" the molecule and vary characteristics of solubility, stability and anti-bacterial specificity. Norwich has already prepared a great many furan and nitrofuran compounds. The company hopes that some of these-especially the non-nitrated derivatives—will find industrial uses (c. g. as solvents) outside the drug field.

# Monsanto to Produce Phenol By New Process on West Coast

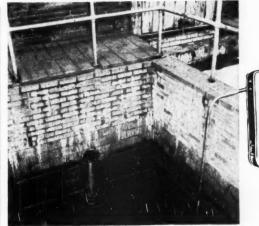
Construction has begun on the new phenol plant of Monsanto Chemical Co. on an 86-acre site at Avon, Calif.

The new plant, expected to be in operation by early 1954, will be jointly built and operated by Monsanto's Western and Organic Chemicals Divisions. It will manufacture phenol by a process recently developed by the company.

Phenol will go to firms in the growing Pacific Coast industrial area, and also will be used by Monsanto to meet expanding needs of its own western nanufacturing operations.

The phenol plant will be Monsanto's largest single production unit on the West Coast.

"Outlets for the production," according to Irving C. Smith, general manager of the company's Western Division, "include petroleum refining and processing, plywood manufacturing, and the making of wood-waste board, insulation, molding compounds and industrial synthetic resins. It is also a key raw material for the chemical industry."





When the pointer can't make up its mind...specify

# Pennsalt Furan Cement

# for your corrosion-proof mortar

If you are the process engineer in a typical chemical unit, facing alternate acid-then-alkaline conditions, then you want to know how best to handle both in corrosion-proof equipment.

The answer is Pennsalt Furan Cement mortar, according to many other plants who have this same problem. Matter of fact, we use it ourselves in our own plants which make everything from household lye to elemental fluorine. And here's why Pennsalt Furan Cement gets the nod:

- Resistant to alkalies, most acids, solvents, greases, organics, salts ... to temperatures of 350-375°F.
- Forms dense, hard, non-porous mortar with excellent abrasion resistance and adhesion.
- Permits narrowest practical widths of joints.
- Longer-than-average working time, easier handling.
- Chemical setting, allowing hardening in confined areas.
- Stable—won't freeze in winter or become viscous in summer.
- Non-toxic, not conducive to dermatitis, not a fire hazard. Contains no vaporizing solvent.

As you know, users of Pennsalt Cements gain the added benefit of Pennsalt's Corrosioneering Service—built around many years of hard-bitten experience in applying corrosion-proof materials in severe chemical environments. Why not write and find out how Pennsalt Furan Cement may answer a corrosion problem of yours? Corrosion Engineering Products Dept., Pennsylvania Salt Manufacturing Co., Philadelphia 7, Pa.



# Gel Pries Earth for More Oil

New process fractures tight oil sands to give the nation more crude petroleum. It uses a chemical gel under high pressure.

You've been hearing a lot recently about West Texas' booming, sprawling, 500,000-acre Spraberry formation "... the largest, though not the most profitable, oil field in the world."

But you may not realize that a new ingenious chemical-using technique—Stanolind's Hydrafrac process—is getting the lion's share of credit for setting off the recent Spraberry oil boom.

This process alone, says Standard of Indiana's Robert E. Wilson, has "already added a billion or more barrels to our proven reserves of recoverable oil." It was first used commercially in 1949, is fast being recognized as a major development in oil production methods. Last year alone, close to 7,000 wells in all parts of the Mid-Continent area got Hydrafrac treatments.

▶ Chemicals and Sand—The Hydrafrac process, developed by Stanolind Oil & Gas Co. of Tulsa, uses a gel (such as kerosene gelled by napalm), a gelbreaking chemical—and sand.

The gel is pumped into the well under pressure to "break open" the tight formation. The gel-breaker is then pumped down to liquefy the gel and make it easier to remove. The sand particles stay behind to "prop up" the fractures so that oil can flow through the new channels.

One or more packers or plugs are set in the hole so that localized high pressure can be built up opposite the dense formation. Sand and crude oil or kerosene gelled with a metal soap (usually napalm) are then pumped into the well until the pressure exceeds the entire weight of the rock above the strata to be fractured.

Below 4,000 ft. the pressure ranges from 0.53-0.85 psi. per ft. of depth. In other words, for a 10,000-ft. well the pressure would range from 5,300-8,500 psi.

The dense formation suddenly fractures for some distance into the main body of rock; the gelled kerosene rushes in to fill the spaces that are opened up.

The amount of gelled kerosene used varies with the depth of the well and the type of formation. The usual range is 2,000-20,000 gal. with 1,000 gal. as the minimum.

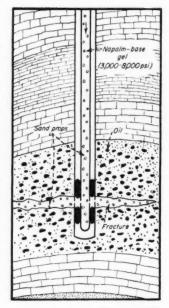
A special chemical is then pumped in to liquefy the gel so that it would be easily removed. A typical treatment would use a volume of liquefier equal to about 1 percent of the volume of gelled kerosene. The liquefier is suspended in crude oil equal to about twice the volume of kerosene.

Sand particles stay in the fractures. Thus when the pressure is reduced the rock does not close tight. Oil drains through these crevices into the well bore.

► For Dry Wells, Too—Stanolind's Hydrafrac\* process is now widely used for treating wells in "tight" formations where it is practically impossible to recover—economically—oil without it.

It's also being used to bring old de-

\* Hydrafrac is a registered service mark of Stanolind Oil & Gas Co.



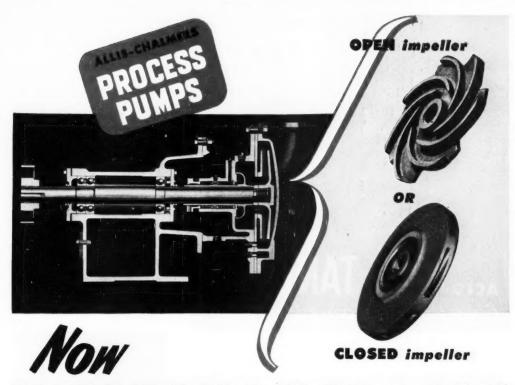
pleted wells back to life. Hydrafrac treatments have already revived many wells that had apparently been drained dry. Thus it is adding hundreds of thousands of barrels of "gravy" to the nation's oil supplies.

The process has been used with success several times in the same well. Besides, an improved technique—the Multifrac process—has just recently



FLOATING THERMOS BOTTLE

Sliding down the ways at New Orleans is first of six steel tank barges with which Freeport Sulphur Co. will transport molten sulphur from its new "amphibious" plant at Bay Ste. Elaine and also from its big Garden Island Bay operation, both in the Louisiana marshland, to storage at Port Sulphur on the Mississippi River. The \$150,000 barges, are 224 ft. long with a 39-ft. beam. Built into each barge is a steel cylinder of 1,000-ton capacity. A 4-in. blanket of insulation and steam coils keep the molten sulphur at 300 deg. F.



# INTERCHANGEABLE

# With NO OTHER Modification

YOU CAN DO MORE JOBS WITH ONE PUMP if it is an Allis-Chalmers Process Pump. You can interchange open and enclosed impellers without making any change whatever in the rest of the pump. Simply remove one impeller and replace it with the other. If you use both open and enclosed impellers in the same plant, your parts stock is reduced because all parts are interchangeable.

ADJUSTABLE FOR WEAR

Both open and enclosed impellers have flat wearing clearances which may be adjusted for wear without dismantling the pump by a simple shimming arrangement. Thus tight clearances and original efficiency

may be maintained over long periods.

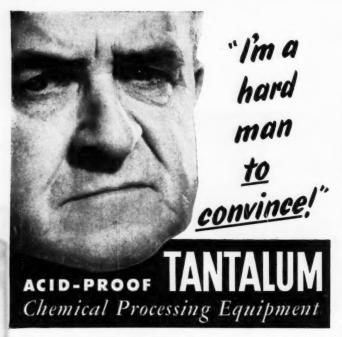
Allis-Chalmers Process Pumps are particularly useful where corrosion or abrasion make it difficult to keep packing in the pump. The packing is on the suction side which limits pressure on the packing to suction pressure. The *Equiseal* sleeve further reduces pressure on the packing. Packing life is greatly prolonged.

To get full information on Allis-Chalmers Process Pumps and how they can reduce your pumping costs, call your nearby Allis-Chalmers District Office or write Allis-Chalmers, Milwaukee 1, Wisconsin. Ask for Bulletin 08B6615.

Equiseal is an Allis-Chalmers trademark.

**ALLIS-CHALMERS** 





"But it didn't take me long to discover what a sound, economical investment it was to use Fansteel ACID-PROOF TANTALUM equipment in my chemical operations. These are some of the reasons that convinced me . . ."

**Acid-Proof:** Not merely "corrosion-resisting." Very few acids, even at high temperatures, have any effect upon tantalum.

**High Strength:** Tantalum is not subject to thermal shock and will stand the strain of great temperature changes.

High Thermal Efficiency: Heating, cooling and condensing efficiencies are surprisingly high.

Saves Cooling Water: Tantalum tapered condensers (shown at right) require a minimum-amount of cooling water, at all seasons and under all operating conditions.

Maintenance Economy: Tantalum equipment is built for long dependable life, freedom from shutdowns, replacement and repair. It usually pays for itself in maintenance savings.

Fansteel engineers are at your service for consultation on any corrosion or heat transfer problem where tantalum can be used economically to your best advantage.

USE TANTALUM WITH ECONOMY for most acid solutions, corrosive gases or vapors; not with HF, alkalis or substances containing free SO<sub>3</sub>.





Acid-Proo

TANTALUM

Fansteel Metallurgical Corporation NORTH CHICAGO TILINOIS U.S.A.

News, cont. . .

been developed to make multiple fractures during the same treatment. Of the first 23 wells treated by multiple fracturing, 87 percent gave an average increase of 340 percent in daily oil flow.

In 1949 Stanolind licensed its Hydrafrac process to Halliburton Oil Well Cementing Co., Duncan, Okla., for commercial service use. During the first three years of commercial use, some 7,800 out of 10,500 Hydrafrac treatments were successful in increasing well productivity. Of all the Stanolind walls treated, 80 percent have had average increases of 90 percent in daily flow.

Thus Stanolind's researchers have shown—with refreshing ingenuity—how chemicals and chemical techniques can be used to solve geological problems and to give the nation more oil.



# New Way to X-Ray Welds On Hot Pipe Saves Hours

A big time saver when it comes to checking partially completed welds on hot sections of pipe is "hot radiography." Using the McElroy-McNutt hot radiography process, X-ray photographs can be taken of large pipes, valves and similar units at temperatures as high as 1,200 deg. F.

Because hot radiography can be carried out at elevated temperatures

it climinates many time-consuming steps required in the usual radiographic inspection techniques.

Radiography involves taking a picture of a material by placing a sensitized film on one side of the material and a source of X-rays or gamma rays on the opposite side. Ordinarily, before the film can be placed on the weld, the pipe section must be cooled down to about 100 deg. F. With certain alloys, this cooling must be preceded by post-heating the weld to relieve internal stresses. Because of the lengthy cooling period required, the weld has usually been completed before it is inspected.

However, hot radiography makes it practical to interrupt the welding operation to inspect the weld root where most flaws occur.

In operation, a special film holder is clamped on the pipe, over the weld to be inspected (see cut). A cooling fluid, circulating through the hollow chambers of the holder, protects the film emulsion from the heat of the welded section. Sam Tour & Co., Inc., of New York, which specializes in industrial problems encountered in metallurgy, chemistry and chemical engineering, holds exclusive licensing rights on the process.

### Fertilizer Industry Seeks To Whittle Down Accidents

The fertilizer industry is moving to cut its high accident rate. The industry plans soon to have its own section of the National Safety Council instead of being only a part of the Council's chemical section.

At a recent meeting in White Sulphur Springs, W. Va., the Fertilizer Industry Safety Committee worked out the final details to secure Council

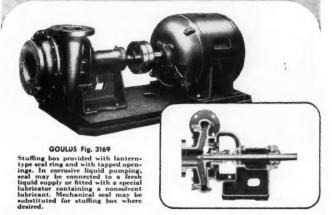
acceptance.

Impetus for the new section comes from the high injury rate experienced in the manufacture of fertilizer chemicals. According to the National Safety Council, the fertilizer industry has an accident frequency of 14.92 disabling injuries per million man-hours-far above the chemical industry's 5.48. Severity, too, is higher: 1.93 days lost per 1,000 man-hours compared with only 0.85 for chemicals.

The committee, now operating within the Council's chemical section, believes that the hazards peculiar to the manufacture of fertilizers deserve special attention.

Safety men from fertilizer plants all

# Goulds single stage. open impeller centrifugal



### Other GOULDS Pumps for the Chemical Industry



### GOULDS Fig. 3705

Stainless steel pumps for handling acid and alkaline liquors. Capacities up to 600 G.P.M. Heads up to 160 ft.



### GOULDS Fig. 3450

These double-suction, single-stage Goulds centrifugals will handle up to 15,000 G.P.M. Heads up to 500 ft. Send for Bulletin 721.2.

# One pump that does many different jobs

- General Water Transfer

- · Processing
- Circulation
- Factory Wastes And Many Others

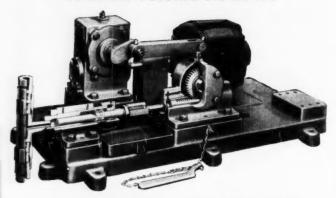
This low cost Goulds Fig. 3169 centrifugal pump offers tremendous versatility. It is as much at home in industrial processing as it is in handling general water service or plant wastes. Its simple, sturdy construction assures long service life with a minimum of maintenance.

Compactly built, this pump is a real space saver. Its modern hydraulic design assures high operating efficiency with relatively low power consumption. Available in a wide range of sizes for both motor and belt drives. Capacities to 1080 G.P.M. Heads to 290 ft. For complete details and specifications, write for Bulletin 720.4.





# For precisely controlled metering and proportioning of small volume flows...



# ...the HILLS-McCANNA "U" Type Proportioning Pump

• The Hills-McCanna "U" Type Pump is designed to continuously meter and proportion small flows of the order of 0.10 to 24 gallons per hour per feed. Its accuracy and reliability suit it for research, pilot plant operation and full scale processing alike. The "U" type pump is suitable for batch or continuous operations.

Typical examples of "U" type pump applications include:

- Continuous addition of air entraining agents during cement manufacturing operations.
- Continuous injection of internal phosphate treatment and sodium sulphite oxygen scavenging in boiler plant water treatment.
- Injection of gasoline gum inhibitors into finished gasoline.
- Proportioning low molecular weight polymers and catalyst solution in resin research.



The new "U" Pump Catalog, UP-52, gives full information on the "U" type pump plus extensive application data including specific service recommendations for handling over 300 substances. Write for your copy, today. HILLS-McCANNA CO.,2341 W. Nelson St., Chicago 18, 111.

# HILLS-McCANNA

metering and proportioning pumps

Also Manufacturers of: Saunders Patent Diaphragm Valves
Force Feed Lubricators • Magnesium Alloy Sand Castings

News, cont. . .

over the United States attended the White Sulphur Springs meeting. Under the direction of Chairman J. S. Fields of Phillips Chemical Co. and Secretary Vernon S. Gornto of the Smith Douglass Co., the committee completed plans for the industry's participation in the 40th National Safety Congress and Exposition, to be held in Chicago, October 20-24.

To implement their decision to cut the accident rate, fertilizer safety men have arranged for Mark Withey of the Trojan Powder Co. to explain at the Chicago meeting safe methods of multiple shot blasting in fertilizer storage.

Dr. J. L. Rosenstein, industrial safety psychologist, will present the human side of safety, while G. D. Blair, fire prevention engineer for Ebasco Services, Inc., will emphasize the importance of designing fire prevention into fertilizer plants, as well as how maintenance reduces fire risk.

In addition, T. J. Clarke, personnel director for G.L.F. Exchange of Ithaca, N. Y., will tell how to conduct a safety meeting, and E. O. Burroughs, Jr., manager of the insurance department of Royster Guano Co., will stress housekeeping in fertilizer plants.

Herbert T. Walworth, industrial hygienist for Lumbermen's Mutual Insurance Co., will attempt to clear the air on the problem of gas and dust control.

### Big Wyoming Soda Ash Plant Now 80 Percent Completed

Its \$16 million trona plant and mine near Green River, Wyo., is 80 percent complete, reports Intermountain Chemical Corp. Intermountain is jointly owned by Food Machinery & Chemical Corp. and National Distillers Products Corp.

The operation is expected to produce 1,000 tons of refined soda ash daily when production gets under way early in 1953.

At the mine, a 1,600-ft, shaft has been put in to supply trona to the new mill. Shaft machinery is now being installed. A big hoist drum for this shaft has already been installed inside the five-story powerhouse.

Six big silos to contain surplus production are nearing completion, while settling tanks, filter houses and other units are about ready for installation of machinery. The shipping and packaging plant is being built at this time





- Vital motor parts protected sealed into inner frame.
- Motor can be reversed without changing direction of the fan fan runs in either direction.
- Uniform ventilation surrounding outside of inner frame.
- Smooth, straight-through ventilating passages.
- Winding electrically insulated 6 different ways.
- Unusually free from vibration.
- Ball bearing housing keeps grease in — dirt out — lubricated for several years' normal service, with grease plugs for additional lubrication, if necessary.
- Easy-to-remove fan guard is held securely in place with two screws.
- Smooth exterior surface is easy to clean.
- Cast iron frame with integrally cast feet resists rust and corrosion — even when mounted in places where processed materials may contact the feet.

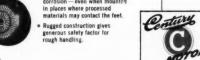
Your property and employees are protected, because this Century Explosion Proof motor is totally enclosed—sealed to prevent a motor spark from causing an explosion.

Class I, groups C and D are used in atmospheres containing flammable gases or vapors: Ethyl ether vapors, gasoline, petroleum, napthha, alcohols, acetone, lacquer solvent vapors and natural gas.

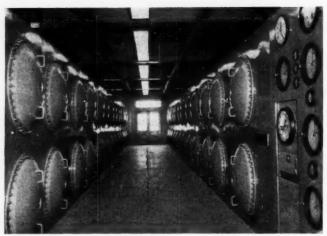
Class II, groups E, F and G are used in atmospheres containing combustible dusts: Metal dust, carbon black, coal or coke dust and grain dusts.

Naturally, corrosive or abrasive materials in the air are also sealed out of the vital parts.

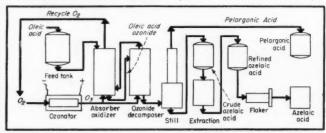
For your protection, specify Century motors on new equipment or for replacement. Your nearby Century Distributor will be glad to give you full information on the complete line of Century motors—from  $V_8$  to 400 horsepower. We are limited in some sizes of the Explosion Proof motor.







GENERATORS such as these will make Emery's ozone installation the world's largest.



OXIDATION process will convert oleic acid into both azelaic and pelargonic acids.

# Ozone Gets a Big Chemical Job

Emery develops a brand new process that'll up output of azelaic and pelargonic acids, lower costs, improve quality. It'll be ozone's biggest job yet.

Ozone-that powerful reagent that has long intrigued process engineers plagued with tough oxidation problems-will soon get its first man-size test in the chemical industry.

For by the middle of next year Emery Industries, Inc., of Cincinnati will put on stream its new \$2 million plant for volume production of azelaic and pelargonic acids. Oleic acid will be the raw material, ozone the oxidizing agent.

Emery will use a new process developed by its own engineers working with those of Welsbach Corp. of Philadelphia. The chemical company's large-scale venture into ozone oxidation forecasts two significant trends:

• A step-up in work on the possibilities of using ozone in chemical oxidation processes, now that equipment and engineering techniques have been developed to make capital of the oxidant's unique properties. Emery will have what's believed to be the world's largest ozone generating set-up and the first really big one in the chemical process industries.\*

 An opening up of the markets for azelaic and pelargonic acids, of which Emery has been the sole producer for about ten years. For the new process will not only increase the yield and improve the quality of these products

it'll also slash their cost.

► Out Goes Chromic Oxidation—As soon as the new ozone process comes in, Emery will no longer use its present chromic acid oxidation process. This method, says Chemical Director Robert Van Tuyle, has always been beset by corrosion problems; these tended to keep the products relatively high in cost.

The chromic acid process—developed by Emery in the early 40's—oxidizes oleic acid with a mixture of chromic and sulphuric acids. The oxidation product is then distilled into pelargonic acid and crude azelaic acid. The azelaic is purified by an extraction process, then sent to a flaking machine.

Spent chrome solution from the oleic oxidizer is regenerated in a bank of electrolytic cells and recycled to the process.

► In Comes Ozone Oxidation—The switch to ozonolysis, Van Tuyle points out, will completely do away with corrosion problems. The results will be lower costs and higher purities. Besides, he emphasizes, new control techniques will permit more rigid specifications on end products.

A bank of stainless steel Welsbach generators of modified design will supply ozone for the new plant. Oxygen gas will be passed through the generating units and subjected to a silent electrical discharge; the potential will range around 15,000 v.

Vice President Victor Hann of Welsbach points out that the use of oxygen instead of air just about doubles the output of ozone from a generator of a given size and electric energy input. Thus the gases from Emery's ozonators will be close to 2 percent O<sub>2</sub> and 98 percent O<sub>2</sub> rather than 1 percent O<sub>3</sub> and 99 percent air.

Since ozone is unstable, it must be used at once and continuously. One of the chemical engineering problems in developing the process was to work out a method for quick and continuous contact with oleic acid before the ozone could revert to oxygen.

Oxidizing agents attack the oleic acid (9-octadecenoic) at the ethylenic linkage in the 9,10-position of the 18-carbon chain. An oleic acid ozonide is formed in the highly exothermic reaction.

This ozonide must then be decomposed or split by more oxidant to form

<sup>\*</sup>Cortisone producers now use ozone, but on a smaller scale. For a flowsheet of the giant ozone plant at the Philadelphia Water Works, see Chem. Eng., Nov. 1949, pp. 168-171.

nine-carbon aliphatic acids.\* Onehalf of the original molecule becomes azelaic—a solid dibasic acid, soluble in hot water and melting at about 106.5 deg. C. It has the formula C<sub>2</sub>H<sub>14</sub> (COOH)<sub>3</sub>.

The other portion becomes pelargonic acid a typical monobasic fatty acid except that it's unique in having an odd number of carbon atoms (9) in its chain. It is a corrosive liquid with the formula C<sub>8</sub>H<sub>37</sub> COOH.

The ozonide decomposer as well as the reactor were developed by Emery's researchers and engineers. They are believed to be unique in design. Certainly the entire process hinges on these pieces of equipment and how they operate.

▶ Recycle Oxygen—Ozone will be used up in the two-step oxidation reaction, while spent oxygen will be recycled to the generators to be converted into more ozone.

Before ozonization, though, the spent oxygen must be cooled and passed through desiccant-type dryers to remove moisture. Activated alumina is the usual desiccant used in ozone generation.

Makeup oxygen to the ozone generators will amount to about 2 percent of the total; some 98 percent will be recycle.

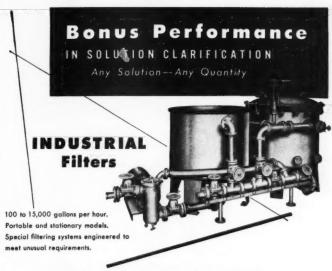
Products of the ozonide decomposer will be sent to a still. There pelargonic acid will be distilled off and packaged as a liquid in drums or tank cars.

Crude azelaic acid from the still will be put through an extractive purification treatment, then flaked and packaged as a solid.

▶ Bigger Markets Seen—Emery's new process will turn out higher quality products at much lower costs. And output will be "increased manyfold," as the Emery people put it.

For these reasons they expect present uses of azelaic and pelargonic acids to expand rapidly, new uses to come up at a fast clip (Chem Eng., May 1952, p. 106).

One promising recent development has been the use of the diesters of dibasic acids in the newer types of synthetic lubricants. Both azelaic and pelargonic acids from stable esters with good low- and high-temperature characteristics and performance. These are important factors in the



# and it's performance that counts . . .

The engineering, design, and construction of Industrial filters have proved out in long service. With the outlet near the top of the chamber a uniform precoat is deposited on the filter leaves as the solution fills the chamber. The outside lockup simplifies the lockup of the leaf and bag assemblies. Industrial exclusive air-wash cleaning method practically eliminates the usual labor, downtime, and the inconveniences of dismantling the filter after each cycle. Industrial filters are often in operation for months without removing the cover. All these features add up to bonus performance—clear filtrate at low over-all cost per gallon.

# Ask for Bulletin 100-CPI

This bulletin gives complete information on Industrial features, the sizes and capacities of the standard models, and details on the uses of Industrial filters for solution clarification.



CORROSION TESTING APPARATUS



# INDUSTRIAL Ion-Exchange Demineralizers For Low-Cost Chemically Pure Water

Standard INDUSTRIAL demineralizer units are available with capacities of 200 to 1000 gph. Special units of any capacity are engineered to requirements.

Write for Full Information and Recommendations

INDUSTRIAL FILTER & PUMP MFG. CO.

5918 Ogden Avenue
Chicago 50, Illinois

LIEBBER DIVISION
WATER
LIEBBER DIVISION

<sup>\*</sup>The oxidation of oleic acid to ozonide, then to pelargonic and azelaic acids, can be represented by the general equation;

C. S. Hr. C. H. (C. H.). C. OOH + O. C. Hr. C. H. (C. H.). C. OOH + O. C. Hr. C. OOH + O. Hr. C. OOH + C. S. Hr. C. OOH).

# Don't listen to Back-Fence Gossip



# THERE'S PLENTY OF QO-Furfural FOR ALL

Furfural production capacity is now adequate to meet furfural demands in this country and abroad. The addition of our new Omaha, Nebraska plant to those at Cedar Rapids, Iowa and Memphis, Tennessee has greatly increased the production of this chemical. This expanded output has resulted from the growing recognition of the usefulness and value of furfural.

Furfural is used successfully in solvent refining of wood rosin, petroleum oils, and vegetable oils, in extractive distillation of C<sub>4</sub> hydrocarbons, as a solvent in making abrasive wheels, and as an ingredient of phenolic resins, as well as a chemical intermediate in preparing the nylon intermediate—adiponitrile. Thus both the physical and chemical properties of furfural are the basis for important uses.

Quaker Oats Technical Staff will be glad to work with you on the application of furfural or its derivatives to your particular problems. Send for a copy of Bulletin 204—"Current Uses of Furfural".

The Quaker Oals Ompany

335G The Merchandise Mart, Chicage 54, Illinois Room 535G, 120 Wall St., New York S, N. Y. Room 435G, P. O. Box 4376, Portland 8, Oregon CHEMICALS DEPT.

In San Francisce: The Griffin Chemical Company • In the United Kingdem; Imperial Chemical Industries Ltd., Billingham, Engiand • In Europe: Qualar Octa-Graanproducten N. V., Rotterdam, The Netherlands; Queter Outs (France) S.A., 42, five Psaguler, Paris 8 P. France • In Australies Swift & Company, Pty., Ltd., Sydney • In Japens F. Kanematsu & Company, Ltd., Tokyo News, cont. . .

field of lubrication and for plastics.

One possibility, Emery points out, is that another water-resistant type of nylon might be made through using azelaic acid as a raw material (with the exception of adipic, azelaic will be the cheapest higher molecular weight dibasic acid now available).

Then, too, Emery's people believe that their basic raw material—abundant, domestic, low-cost animal fats and tallows—puts them in a strong position, especially during periods of national emergency. For example: sebacic, the dibasic acid nearest to azealaic in chemical properties, is made from relatively high-cost, imported castor beans.

And you can pretty well bank on one thing: Emery's pioneering venture into large-scale ozone oxidation will eventually open up entirely new fields for fatty acids and their derivatives.

# Reichhold Invades Ripe Powdered Phenolic Market

Already a potent factor in bonding and laminating plastics, Reichhold Chemicals, Inc., plans to manufacture and market powdered phenolics for such industrial applications as molding compounds, foundry shell molds and cores, brake linings, grinding wheels and wood waste products.

As a result of completion of expanded facilities at its Tuscaloosa, Ala., plant, Reichhold, the nation's third largest producer of phenol, will turn out 60 million pounds of phenol a year.

Completion of installation of new 10,000-gal. stainless steel kettles at RCI's Detroit, Mich., and Elizabeth, N. J., plants as well as at Tuscaloosa, also makes possible vastly increased production of phenolic resins at these locations.

"Previously about 10 percent of Reichhold's annual business of \$100 million was done in liquid phenolic resins, but with completion of research and installation of new equipment, the firm anticipates increasing its business to a point where 50 percent of its volume will be in the plastics industry with its new solid and powdered resins." Harry Kline, vice president in charge of phenolic plastics, declares.

"One of the largest potential users of the new product is the foundry industry." Kline says, "which has be-

# FIGHT CO with HAV

# PIPING

HAVEG

FIGHT CORROSION ALL THE WAY with HAVEG PIPES, DUCTS, VALVES

PIPES: Produced in diameters of ½" up, HAVEG piping comes in lengths to 10'. It can be cut and fitted on the job. Expansion joints are used when the line is not free to move lengthwise, especially in hot service. Remember, HAVEG piping takes 265°F. and will not crack under expansion or contraction. It weighs roughly one fifth that of iron and is highly resistant to corrosion through and through. HAVEG is unaffected by HCL in all concentrations, takes HsOo, up to a 50% concentration, and is resis-

DUCTS: Corrosive gases or fumes can be handled safely and economically in entire systems that the safely and economically in entire systems that the safely and economical or rectangular shapes (diameters of 2" up). Because HAVEG is a moided plastic, it is individually tailored to your needs, using low-cost molds and modern methods. Fume hoods, bifurcators, fan housings, expansion joints, fittings, all made from HAVEG belong in your present or contemplated fume system.

tant to Acetic Acid.

WALVES: HAVEG is easily molded into a variety of valve bodies. Outstanding are the all-HAVEG "y" valve and the Hills-McCanna Saunders Patent Diaphragm Valve. The latter features a diaphragm which isolates the working mechanism from the corrosive liquid with the HAVEG body giving its usual resistance to corrosion and long service life. (Acid pumps are also machined out of HAVEG. No metal contacts the liquid, so no corrosion, no contamination.) Consult your HAVEG sales engineer for latest details on HAVEG used in valves and acid pumps.

What makes good chemical piping? Strength. Durability. Light Weight. Resistance to Corrosion and Thermal Shock.

Think how HAVEG piping combines all of these desired qualities: It takes rapid temperature changes and can be used continuously up to 265°F. It resists corrosion of practically all acids (except oxidizing acids) and lasts for years without repairs or maintenance. The specific gravity of HAVEG is 1.6 and it is a material readily molded into countless strong shapes and forms. You must fight corrosion all the way, so do it with HAVEG which is not a coating or a lining. Call in your HAVEG sales engineer . . . have him show you installation photos, the wide variety of molds stocked at the Marshallton plant. HAVEG production has recently been increased . . . deliveries are much improved.



It's a long story, telling all about HAVEG! It takes 64 pages of text and photos to show what HAVEG is (a molded plastic made into tanks, towers, pipes, valves, agitators, etc.); what grades and forms are made, and how it can help you fight corrosion all the way in your plant.

Get your copy of HAVEG Bulletin F-6 now. It is a helpful, technical manual that belongs in every chemical engineer's reference library. Write now, for corrosion is always at its destructive work. HAVEG can help you!

# HAVEG CORPORATION

NEWARK 8, DELAWARE

FACTORY . MARSHALLTON, DELAWARE . TEL. WILMINGTON 3-8884

CLEVELAND 14 550 Leader Bidg. Cherry 1-7297

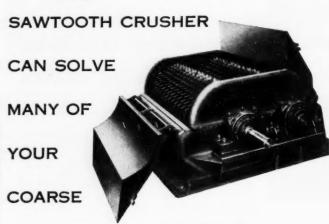
CHICAGO 11 1201 Palmolive Bidg. Delaware 7-6266

DETROIT 35 1995) James Couzens Hghwy Broadway 3-0880 CHATTANOOGA 2 825 Chestnut St Tel 7-7478

HARTFORD 5 86 Farmington Ave. Hartford 6-4250 HOUSTON 4 4101 San Jacinto Jackson 6840 LOS ANGELES 14 523 W. Sixth St. Mutual 1105 SEATTLE 7 5600 14th Ave. N W Hemlock 1351

# why

# THE SPROUT-WALDRON



# SIZE REDUCTION PROBLEMS:

**because** of its unique design, the Sprout-Waldron Sawtooth Crusher can provide either a shredding, tearing or shearing action. The type of action delivered depends upon the characteristics of the material being processed and speed differential at which rolls are run.

**because** of its shearing action, the S/W Sawtooth Crusher can perform many size reduction operations with a minimum of fines.

> because of its tendency to pull materials into and through the reduction elements, the S/W Sawtooth Crusher is used extensively in breaking up sheeted materials as they come from cooling conveyors or drier belts.

why not write for complete details about how the S/W Sawtooth Crusher can help to solve your coarse size reduction problems? Our wide experience in solving many types of size reduction problems in the chemical processing and allied fields is always at your service. Write to Sprout-Waldron & Co., Inc., 15 Logan St., Muncy, Pennsylvania.



# SPROUT-WALDRON

The Bost in PROCESSING EQUIPMENT Since 1886

News, cont. . .

come aware only recently of the benefits offered by the shell molding process."

About 100 of the 6,000 foundries in the United States are now using or experimenting with the new process, and within five years, 25 percent of the industry will be using shell molding, Kline predicts.

# Integrated Nylon Plant Rising Near Pensacola

When completed the new plant of Chemstrand Corp. near Pensacola, Fla., will be the first integrated nylon plant in the United States.

The plant comprises two basic areas, the chemical area where intermediates are produced and the textile area where the fiber will be spun. In addition, there are many other structures; nearly 30 separate units, plus storage tanks, comprise the entire project. All are of the most modern design and construction.

Nylon salts will be produced in the chemical area to meet requirements of the textile area for spinning nylon filament yarn. Heretofore, nylon salts have been produced at separate locations and shipped to spinning plants elsewhere in the country.

The entire plant is being built on a 120-acre site at the center of Chemstrand's 2,000-acre tract along the Escambia River 12 mi. north of Pensacola. The plant will employ upwards of 3,000 when completed.

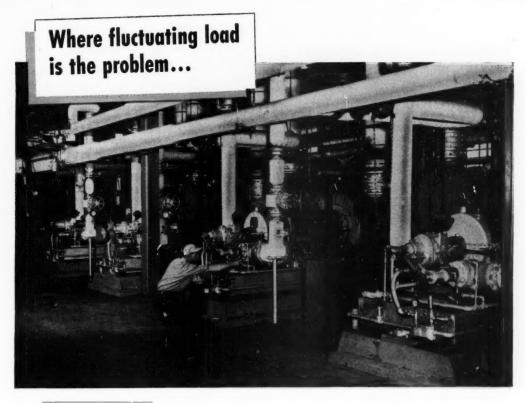
Dominating the textile area is the spinning building, which measures 600 by 750 ft. This area is expected to be kept on a 24-hr. work-day basis, and will employ about 2,300 workers on three shifts.

The chemical area will occupy a plot 800 by 1,000 ft. and will consist of facilities to produce the salts.

Other facilities include an office building, where 150 will be employed, and laboratories, warehouses, maintenance shops, power plant and tank storage facilities.

Some raw materials will come from the Texas Gulf Coast via the Inter-Coastal Canal and Escambia River, and others by rail and truck. Outgoing shipments will move primarily by rail and highway.

Nylon products will range from fiber for hosiery to fiber for tire cord. Fiber will also be produced for other clothing and industrial applications.



# TYPEE gearturbines can handle it!

Process requirements in the evaporator room of the Masonite Plant, Ukiah, California, called for a variable-speed pump drive to provide for fluctuating load conditions. Steam was available. In the words of this user: "Westinghouse Type E, Close-coupled Gearturbines were selected since the pumps had to operate at relatively low speeds, and the higher efficiency inherent in the high-speed turbines was desirable. In operating performance, these turbines have proved the most efficient and economical solution to our problem."

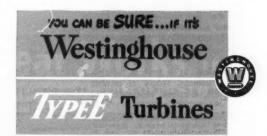
Also in the evaporator room, the Masonite Company selected four Westinghouse Type E Turbines to drive the boiler feed pumps. These turbines provide an efficient, trouble-free drive which can be driven by the existing steam supply. Motor-driven units are used as stand-bys.

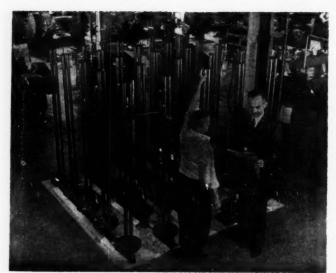
This use of both types of Westinghouse Turbines is the kind of over-all unit responsibility that actually makes your job of purchasing, installation, and maintenance easier... more dependable.

Wrapped up in a single package is a compact, rugged,

and reliable speed-reduction unit solidly coupled to a Type E turbine. Each gearturbine is mounted on an extremely rugged base, fabricated of heavy steel plate which forms the oil reservoir. This arrangement simplifies mounting and installation. It provides operating stability never before available.

Get the full story on the broad Westinghouse turbine line. Book B-4346 clearly explains the applications, refinements and distinct standard features of Westinghouse Gearturbines. Call your nearby Westinghouse office, or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Penna.





TANTALUM BATONET HEATERS are ready for packaging. These units were sent to petrochemical plants for use in sulphuric acid recovery processes.

# **Tantalum Goes Chemical**

For years, the electronics industry has been the chief consumer of tantalum. Biggest use now is in equipment for handling extremely corrosive chemicals.

Administrator Jess Larson of the Defense Materials Procurement Agency this summer set up a program to purchase tantalum ores. Under this program the government, wanting to stimulate discovery and development of tantalum deposits, is going to pay a bonus of 100 percent of the base price to the actual producers of the ore. By 1956, when the program ends, Larson hopes to acquire 15 million pounds of ores and concentrates.\*

Although commercially much older than titanium, tantalum is still a youngster in the metals field. First used in piddling amounts in 1923, tantalum sales climbed steadily during the 30's. But since 1939, sales have jumped a substantial 1,000 percent. Chiefly responsible for the upsurge is a growing market in the chemical industry.

Tantalum cut its teeth in the electronics industry, chiefly in rectifier electrodes, electronic tube parts and electrolytic capacitors. But chemical usage has been steadily challenging the electronics field.

By 1948, chemical plant equipment sales began to push in front of electronics sales. Since then they have maintained their lead, in fact increased it; so that today tantalum has established itself primarily as a material of construction for hard-to-handle chemicals.

▶ Why the Tantalum Surge—Chemical engineers are primarily interested in tantalum because of its non-corrosive properties. As a material of construction, its chemical resistance closely resembles that of glass (see Chem. Eng., April 1952, p. 259). It has been used in operations where no other metals—that includes gold and platinum—could be used.

Specifically, tantalum, which has a high thermal conductivity, has gone principally into heat exchangers (shelland-tube, coil, bayonet). Biggest item made so far is a 174-tube exchanger with a heat-transfer area of 187.5 sq. ft. It's part of a production line on which ammonium chloride is made.

Right now, the chief drawback of tantalum equipment, design engineers lament, is its high price. Fabricated, it runs \$120-220 per sq. ft. of heat-transfer area. But tantalum salesmen do not put their product in the same class as nickel, aluminum, stainless and bronze. They point out that it takes over where these less noble metals leave off.

Compared with precious metals, a 0.015-in. tantalum sheet would sell for about \$50 a lb. The same sheet in silver would sell for \$10.80 a lb.; in gold, \$420; in platinum, \$2,420.

Oddly enough, the price of tantalum actually is going down. In spite of increased costs, the price has dropped over 30 percent since 1941. Reason: Besides the increased market, engineering improvements give more product with less labor. In 1941, for example, eight man-hours of sintering produced 6 lb. of metal; today, output with the same labor is 98 lb.

► Who Makes It—When production started back in 1922, Fansteel Metal-

Where Tantalum is Going in the Process Industries

Industry Bromine	Equipment	Operation
	Heater and condenser of fractionating still.	Getting bromine from crude mixtures of chlorine and bro- mine.
Hydrochloric Acid	Heater and condenser of fractionating still.	Distillation of CP hydrochloric.
Nitrie Acid	Heater and condenser of fractionating still.	Distillation of CP from crude.
Electroplating	Heaters.	Plating baths holding chromic- sulphuric mixtures.
Hydrogen Peroxide	Heating element in still.	Distill hydrogen peroxide.
Petrochemical	Condensers.	Preparation of ethylene bro- mide.
Petrochemical	Heat exchangers.	Preparation of chlorinated ben- zene.
Petrochemical	Heaters.	Recycling and recovery of sul- phuric acid.
		phunic acid.

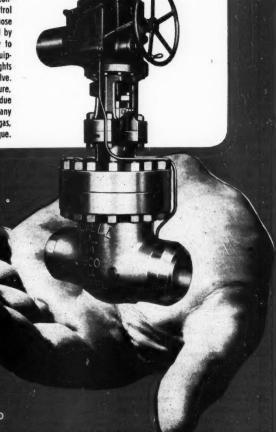
<sup>\*</sup>These ores also contain columbium, which is likewise in demand. High-temperature columbium alloys are used to build jet engines.

# LIMITORQUE

puts Valve Operation in the hands of Key Workers

Valves of all types up to 120" diameter can be opened and closed easily and quickly with LimiTorque. Conveniently located push button stations are the control centers from which remotely located valves, or those in high or hazardous locations may be operated by highly responsible employees. It is unnecessary to entrust important valve operations and valuable equipment to men chosen for brawn alone. Indicating lights show at a glance the exact position of each valve.

Because of its adjustable valve seating feature, LimiTorque will prevent damage to valve parts due to overload. LimiTorque may be actuated by any available power source such as electricity, water, gas, oil or air. Your valve maker can supply LimiTorque.





ERIE AVE. AND G ST., PHILADELPHIA 34, PA.
NEW YORK - PITTSBURGH - CHICAGO - HOUSTON - LYNCHBURG, VA.

Industrial Gears and Speed Reducers LimiTorque Valve Controls

MITORQUE

lurgical Corp., the nation's only primary producer, was turning out matchstick size ingots. Today's ingots are 1,000 times that size, says Fansteel, declining to mention any dimensions. To keep up with the growing market, Fansteel itself has been expanding. Right now it has a \$750,000 program in the works.

Fansteel, however, is not the sole fabricator. Pfaudler, who buys rod and sheet from Fansteel, also fabricates equipment. But probably because of its special experience in the field, Jess Larson appointed Fansteel to act as Government purchasing agent under the new guarantee-purchase program. Other purchasing agents, just recently appointed, are Wah Chang Corp., New York City, and the Emergency Procurement Service of the General Services Administration.

In the early days, tantalum was practically limited to use as rectifier electrodes and diaphragms in regulating and proportioning valves. Chicago water treatment plants, for instance, used the valves to control chlorine flow. The diaphragm, actuated by water flow in the main line, admitted controlled ppm. of chlorine; any corrosion damage would throw them off. ▶ Where It Comes From-To get its ore. Fansteel has to shop all over the world. Tantalum ores usually occur in pegmatite dikes, and are associated with columbium, beryl and other minerals. Major ore is a mixture of tantalite and columbite; percentage varies with location and even within the dike. Today, most tantalum comes from three different continents-South America (Brazil), Africa (Belgian Congo) and Australia.

The field of tantalum deposits, however, is wide open to grazing prospectors. A medium quality ore found in the Black Hills could possibly be developed. Other tantalum minerals, which as yet have not been exploited, are simpsonite (aluminum tantalate), microlite and manganotanlalite.

► How It's Processed—Fansteel has made no recent changes in the ore recovery process.† But, as part of its expansion program, Fansteel does plan several improvements: (1) Continuous fusion will replace batch ladle fusion; (2) a continuous separator will replace the filtering tank; (3) units will be added to remove manganese and iron;

and (4) facilities will be added to convert tantalum to the fluoride.

After tantalum is recovered from its ore, the pure dry powder is weighed to ingot size, then compacted by 50 tons per sq. in. pressure into brittle bars or other shapes. Bars are sintered by resistance heating at almost 3,000 deg. C. by passing several thousand amperes through them while in a 1-micron vacuum. Formed shapes are sintered by induction heating. A time-temperature control brings heat up gradually, cools things off slowly.

Fansteel's new 36-in. rolling mills will soon double the maximum available sheet width. After the rolled sheet is formed, it is welded—no welding rods are necessary—into process equipment. The type of seam determines whether submerged resistance welding or an adaptation of inert gas are welding is used.

Tantalum is very ductile and malleable. It can be cold-worked by slight modification of conventional techniques. It can be bent, stamped, spun or deep-drawn. Between operations, it requires little annealing. But, an induction anneal in a tantalum-lined fused silica tube relieves cold working stresses between fabricating operations.

#### Radioactive Polonium Offered by Oak Ridge

Radioactive polonium-210 can now be purchased at Oak Ridge for research purposes. Polonium is the first reactorproduced radioisotope to be sold that emits alpha particles. It can also be used as a source of high-energy neutrons.

The Isotopes Division of AEC says the polonium is needed for physical and biological research. It may also be used in oil well logging and for ionization sources.

In addition, the element could be used in luminous phosphors, static elimination devices, and for other industrial purposes. However, not enough is available yet for such uses.

Polonium can be bought at Oak Ridge in two forms. When it is to be used as a neutron source, the polonium will be mixed with beryllium and inclosed in a nickel cylinder about \( \frac{1}{2} \) in. in diameter. As an alpha source, the polonium will be plated on a strip of platinum.

Polonium-210 produced in a reactor of neutron bombardment of bismuth

is of higher purity than polonium derived from the radioactive decay of radium.

#### Seattle Smelter to Process Tin Concentrate From Alaska

Pilot plant work now being carried on by U.S. Tin Corp. in cooperation with General Refining & Chemical Corp. may lead to construction of a tin smelter in or near Seattle. Cost of the smelter: an estimated \$250,000.

U.S. Tin plans to expand its operations at Lost River, 100 mi. northwest of Nome, Alaska, to provide a capacity of 5 tons of tin and tungsten concentrate every 24 hr. from 200 tons of ore. The plant presently can process only 10 tons of ore per day.

Until the Seattle smelter is built, concentrate will be shipped to New York for processing to recover tungsten and then to Texas City for ting smelting.

The Lost River expansion will include installation of 20 concentrating tables.

#### Dow Wants to Know What Neighbors Think of It

Dow Chemical Co. wants to see itself as others see it.

To do that, it has arranged for Opinion Research Corp. of Princeton, N. J., to make a survey in the Freeport, Tex., area. Trained interviewers from outside the Freeport area will conduct the survey.

About 40 questions will be asked of hundreds of residents in Freeport, Velacso, Clute, Lake Jackson, Oyster Creek, Jones Creek, Angleton, Brazoria, West Columbia and Alvin.

Persons interviewed will not sign the questionnaire and their names will not be used. Opinion Research Corp. will make its analysis and report the results only to Dow.

Dr. A. P. Beutel, vice president of Dow and manager of the Texas division, says the survey is to find out what people think of the company and how it can become a better citizen of the community.

"Just as we go to our customers for advice about our products, we are going to the community for advice about our policies and our actions," Beutel says. "The results of the survey should be very helpful to Dow in the future."

<sup>†</sup> For a description of the process see Chem. Eng., Sept. 1948, p. 152.

#### New Producer to Make Phosphates With Nitric

Phosphate fertilizer will be produced by the TVA process, which uses nitric acid instead of sulphuric, when the plant of Associated Cooperatives, Inc., at Sheffield, Ala., goes into operation next year.

A new concern, Associated has purchased part of Nitrate Plant No. 1, erected in 1917 to produce explosives, and hopes to be the first commercial operation in the United States to use a process based on the work of TVA in its pilot plant.

When it gets into full production in 1953 the plant will turn out about 60,000 tons of 14-14-14 fertilizer a year. Plans call for an acid plant to produce 60 tons of nitric per day.

Present buildings will be converted and new equipment installed at a cost of about \$2 million. A. J. Sackett & Sons Co. of Baltimore will build the phosphate plant.

The process will use nitric acid, phosphate rock, potash, anhydrous ammonia and phosphoric acid. Important point in production of the nitraphosphate fertilizer is that the process does not require sulphuric acid presently in short supply. This process is similar to the one used by I. G. Farbenindustrie in Germany (see May 1951, pp. 166-169).

#### High Yields of Thallium Recovered by Two Methods

Two methods for recovering thallium from white arsenic and from lead smelter flue dust have been developed at the Intermountain Experiment Station of the U.S. Bureau of Mines in Salt Lake City, Utah.

Thallium, a rare metallic element of growing strategic and industrial importance, is widely distributed. However, it is found in traces and can be recovered only as a byproduct in processing ores of other metals.

Using smelter products furnished by the American Smelting & Refining Co., Bureau metallurgists were able to retain in a residue more than 99 percent of the thallium from a white arsenic containing 96 percent arsenic trioxide and 0.21 percent thallium.

From the lead smelter flue dust, 90 percent of the thallium was recovered in thallous chloride crystals, which were readily purified into a final product of over 99 percent purity. Over-all





They said, "Let it go... we've got to get started on this, we can come back *later* to the heat exchangers." But bad luck beat them to it... be came back to the heat exchangers first! The product of that delay was a costly tie-up of men and equipment.

Shut-downs were necessary while heat transfer units were repaired and replaced. How much easier it would have been to have called on the experienced engineering staff of the Western Supply Company . . . turned the heat transfer problem over to them . . . and THEN gone on to the other major process consideration. Western serves the Chemical Process Industries as heat exchanger specialists with the very best of men . . . machinery . . and materials. Remember that shelved heat transfer problems spell future trouble . . . call on Western Supply Company and eliminate the possibility of that trouble NOW!



Also At WESTERN

CHAPMAN Valves
CRANE Valves
TAYLOR Fittings
and Flanges
NORDSTROM Valves



News, cont. . .

recovery of thallium in the refined crystals exceeded 85 percent.

Volatilization was the method employed to recover thallium from the white arsenic. Cyclic leaching was used to get it from the lead smelter flue dust.

#### New Cat Cracker Part Of Refinery Expansion

Richfield Oil Corp. will spend \$40 million to expand its Watson refinery near Long Beach, Calif. Work is just getting started, with completion expected during 1954.

Construction will include a new fluid catalytic cracking unit; Richfield claims it will have a larger capacity than any similar unit on the West Coast. Capacity for aviation gasoline will be increased almost threefold to more than 500,000 gal. a day. Total gasoline output will be boosted more than 40 percent to 2,750,000 gal. a day. After the expansion the refinery will be able to process more than 125,000 gal, of crude oil daily.

Contracts have been awarded to C. F. Braun of Alhambra, Calif., and Fluor Corp. of Los Angeles. Braun will build the catalytic cracker. The contract for a new polymerization plant has still to be awarded.

#### Detergent Plant Acquired In Petrochemical Expansion

Continental Oil Co. has purchased the synthetic detergent plant of Stepan Chemical Co. in Chicago. Conoco's petrochemical department will operate the plant, which will continue to produce synthetic detergents for the Midwest market.

Stepan Chemical will continue its other manufacturing operations at its new plant recently completed in Chicago.

Acquisition of the Chicago detergent plant, one of the largest in the Midwest, gives Conoco a fully integrated operation for manufacturing synthetic detergents. The company's present plant in Baltimore, Md., produces raw materials, which will now be shipped to Chicago for conversion into finished detergents.

"The purchase of the Chicago plant," says Harold G. Osborn, vice president in charge of manufacturing for Continental, "marks a further step in the expansion of our activity in the



# Resin Producer Ends Contamination – Speeds Drying – Saves \$40,000 A Year with Louisville Dryer

KNOW THE RESULTS before you buy!

#### FORMER DRYER

#### LOUISVILLE BRYER.

YEARLY SAVINGS OF

LOUISVILLE DRYER

IN OPERATING COSTS

ALONE . . . \$40,000

Sometimes the cheapest drying methods are the most expensive:

Take the case of this producer of synthetic resin for plastics.

Take the case of this producer of synthetic resin for plastics. His situation was studied by a Louisville engineer who uncovered this fact: by investing more money in a Louisville Dryer—especially designed for the job—savings would more than write off the cost of the new equipment in less than 2 years. In addition, total enclosure of the material to be dried would mean no contamination from airborne dust, dirt. Speeded-up drying time improved product quality.

Tests in our own research laboratories and pilot plant predetermined the performance of this custom-built dryer. Have a Louisville engineer survey your drying methods. No obligation. Write today.

Ask for new treatise on subject of rotary dryers

Other General American Equipment: Turbo-Mixers, Evaporators, Dewaterers,

Turbo-Mixers, Evaporators, Dewaterers,
Towers, Tanks, Bins, Filters,
Pressure Vessels



#### Louisville Drying Machinery Unit

Over 50 years of creative drying engineering
GENERAL AMERICAN TRANSPORTATION

CORPORATION

Dryer Sales Office: Hoffman Bldg., 139 So. Fourth Street
Louisville 2, Kentucky

General Offices: 135 South La Salle Street, Chicago 90, Illinois

Offices in all principal cities
In Canada: Canadian Locomotive Company, Ltd.
Kingston, Ontario



ADVANTAGES OF DAY TYPE "AC" DUST FILTERS

Continuous-Automatic Operation...
reverse air jet rings move slowly up and
down the filtering tubes, cleaning continuously.

Constant Air Volume . . . assured by back pressures leveling off after starting.

Higher Air-To-Cloth Ratio . . . 10, 15,

or even 20 to 1 ratios with uniform back pressures.

licensed by H. J. Hersey, Jr.

Smaller Units, Less Floor Area Required ... with no sectional shutdowns necessary for cloth cleaning, less filter is required for equal volumes of air.

Separated Dust Streams . . . several different product streams may be handled simultaneously without mixing.

EASY PLANT HOUSEKEEPING: The 3M Company also reports that these advantages make plant housekeeping easy and result in a clean plant—an aid to employee morale, high production and low plant maintenance costs.

#### 71 YEARS' EXPERIENCE IN INDUSTRIAL DUST CONTROL

The DAY Company is proud to offer skilled engineering and service gained through 71 years' experience in the engineering, manufacture and installation of dust control systems for industry. If you have a dust problem, DAY can provide an effective and economical solution. DAY engineers are at your service for plant studies and cost estimates. CALL OR WRITE-TO-DAY FOR MORE INFORMATION.



News, cont. . .

field of petrochemicals. It will enable us to better service the greatly increased demand for synthetic detergents in industry."

Continental is currently enlarging its Baltimore plant, which produces raw materials for synthetic detergents, to three times its present size. Its petrochemical expansion plans also call for construction of a \$2 million plant in Ponca City, Okla., for the manufacture of lubricating oil additives. In addition, the company is part owner of a plant at Lake Charles, La., producing high abrasive carbon black for use in synthetic rubber.

Conoco has been active in petrochemical activities for many years, but last year launched an expansion in this field with the appointment of Dr. John E. Kircher, industrial chemist, as manager of a newly created petrochemical department.

#### Silicon Carbide Research Yields Thermodynamic Data

New information about the thermodynamic properties of silicon carbide has been gained in experiments by the Bureau of Mines.

Silicon carbide, made by heating carbon and sand together in an electric furnace, is used as an abrasive and as a refractory lining for high-temperature furnaces. Little is known, however, about its thermodynamic properties.

Physical chemists in the Berkeley, Calif., laboratory of the Bureau have treated experimentally two varieties of silicon carbide and tabulated heat and free energy values for its production. They also investigated reactions involving gaseous silicon monoxide and elemental silicon as possible intermediates in silicon carbide formation and found them to be thermodynamically feasible under certain conditions

#### Conversion to Cold Rubber Steps Up Plant Capacity

A new type of heat exchanger and a faster acting chemical formulation will greatly increase output of GR-S at the Port Neches, Tex., synthetic rubber plant run by Naugatuck Chemical Division of United States Rubber Co. The plant is being converted to cold rubber production and its capacity increased from 70,000 long

tons to more than 100,000 long tons annually.

Conversion and expansion are expected to be completed by late fall. Cost will be about \$2.5 million.

The increase in plant capacity is made possible by new fast-acting chemical formulations for GR-S rubber and by a new type of heat exchanger developed by Naugatuck engineers.

The heat exchanger will carry away heat generated during the chemical manufacturing process at a faster rate than older equipment. This will cut time needed to make cold rubber from a normal 14 hr. to 8 hr.

One of these heat exchangers will be installed inside each reactor on the plant's four production lines. In addition to increasing cold rubber production, the heat exchangers will lower the plant's unit operating costs.

#### Foote Gets Fast Writeoffs For Lithium Expansion

Two certificates of necessity have been granted to Foote Mineral Co. by the Defense Production Authority as part of the 10 million pound per year goal for production of lithium chemicals recently set by DPA.

One certificate for \$2,515,000 carries an 80 percent amortization and covers production of lithium chemicals at Sunbright, Va. The other, for \$144,828, carries a 70 percent amortization and covers the mining of spodumene concentrates at Kings Mountain, N. C.

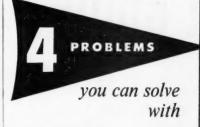
These certificates represent only part of the expanded facilities that Foote has planned for this year and next in the lithium chemical industry. The complete expansion program amounts to about \$3 million in facilities, and will more than double the present U. S. production capacity of essential lithium chemicals.

#### Lion Oil Awards Contracts For New Ammonia Plant

Lion Oil Co. has let contracts covering the design and construction of its new Barton chemical plant to be constructed at Luling, La. Chemical Construction Corp. is to be architect-designer of the plant, and Lummus Co. will be prime contractor for construction.

The new plant will be located on a 1,400-acre site on the west bank of the Mississippi River about 14 miles increase the efficiency...
reduce operating costs...

# IN YOUR POWER PLANT!



### **BECKMAN pH Control**

Make vitally important savings in the cost of operating and maintaining your power plant by Beckman-controlling the pH of your feed water and steam processes. You can protect costly plant equipment against damaging calcium deposits... can reduce requirements of costly chemicals and treating materials.

There is a size and type of Beckman pH meter—from strictly portable to installed, completely-automatic pH control—for every power plant requirement.

## REDUCE COSTLY CORROSION

(especially in steam condensate equipment). Rate of corrosion is a function of the pht of the water. Maintaining high plf minimizes corrosion through formation of protective oxide coatings, pht must be sufficiently high to minimize corrosion, yet low enough to prevent calcium precipitation (see below). Peak efficiency can be obtained only through accurate pht control!

# 2 PREVENT CALCIUM DEPOSITS

For each type of softening operation there is a definite pH at which optimum precipitation of colcium is obtained. By controlling the pH, minimum residual hardness is assured. Then, what little hardness remains, is prevented from precipitating in condensers, exchangers, valves, etc., by lowering the pH in this part of the system. Again—peak efficiency can be obtained only through accurate pH control!

## OBTAIN MAXIMUM

in removing impurities through coagulation. Formation of the floc is greatly influenced by the pH of the solution and type of coagulant used. If alum is used, maximum floc is obtained at a moderately acid pH value ... if sulphates predominate a lower pH value gives best floc... while if chlorides predominate, a higher pH value (slightly alkaline) must be maintained. Optimum sedimentation can be obtained only through accurate pH eontrol!

# PROTECT VALUABLE ZEOLITE

Zeolites are rapidly disintegrated by water with low pH and are also soft-tened and disintegrated by water of high pH. By Beckman-controlling pH before water enters Zeolite, costly chemical losses are eliminated and vital plant economies are effected. Here again, topmost efficiency can be obtained only through accurate and controlling the controlling through accurate and controlling through a controlling through the controlling through a controlli

Illustrated at right is the Beckman Model R pH Indicator—the ideal equipment for power plant installations.

For more details on Beckman pH Equipment and the savings to be made in power plant applications, write for your free copy of Data File 82-14



-BECKMAN INSTRUMENTS

#### BECKMAN INSTRUMENTS, INC.

South Pasadena, California Factory Service Branches: New York - Chicago - Los Angeles

the Mississippi River about 14 miles | BECKMAN INSTRUMENTS Include: pil Motors and Electrodes - Spectrophotometers - Radioactivity Motors - Special Instrument



# ELDCO gives you

# this TWIN GUIDE



## to BETTER TUBING SERVICE

# Dependability

Whenever you need reliable tubing, specify Weldco and be sure of getting the best. For Weldco is made by tubing specialists . . . men who have the equipment, facilities and experience to give you a product that's properly welded, carefully finished all the way through. For topquality tubing, mechanically and metallurgically sound, you can always depend on Weldco.

## Versatility

Youngstown Welding's plant facilities are geared to both large scale production and small quantities of oddsized tubing. With this operating flexibility, we can produce a complete range of sizes—in the shortest possible time—to meet all your tubing needs. Weldco's versatility also gives you a choice of many different alloys—Stainless Steel, Monel, Inconel, Nickel, Cupro-Nickel, and Everdur, in sizes from 31/2" to 30" O. D.

Send today for complete information on this corrosionresistant tubing, and remember . . .

Whatever Your Needs In Tubing ... You're Way Ahead With WELDCO

THE YOUNGSTOWN WELDING & ENGINEERING CO. 3714 OAKWOOD AVE. YOUNGSTOWN 9, OHIO News, cont. . .

upstream from New Orleans. It will consist mainly of outdoor type process units with modern one and two-story buildings for administration, maintenance, warehousing and employee services. Unless construction is delayed by shortages of material and equipment, the new plant is expected to be operating early in 1954.

Products to be manufactured include anhydrous ammonia and prilled ammonium nitrate. Nitric acid will be produced in an intermediate manufacturing step. Natural gas for fuel and as a processing raw material will be supplied by the Texas Co. from nearby fields in Louisiana.

#### **New Synthetic Fibers Goal** Set for Non-Cellulosics

The Defense Production Administration has called for a total annual production capacity of 300 million pounds of non-cellulosic synthetic fibers by January 1956. This is an increase of 200 million pounds over 1950 capacity.

Biggest increase, according to DPA will come in nvlon, needed to meet requirements in the event of full mobilization. The projected increase is based primarily on needs for military products.

Of the new productive capacity called for, 80 million pounds have already been granted DPA approval DPA says no goal is planned at present for new facilities to increase output of high-tenacity rayon, rayon staple or rayon filament yarn.

#### **New Dryer Installed for** Sulphite Liquor Research

New drying equipment just installed at the Appleton, Wis., pilot plant of the Sulphite Pulp Manufacturers' Research League will be used in the search to find uses for spent sulphite liquor from Wisconsin pulp mills.

Key to cutting stream pollution at a cost that the mills can afford is finding ways to utilize spent sulphite liquor so it won't have to be discharged into rivers.

Recent technical progress indicates that worthwhile quantities of liquor may find uses as an industrial raw material when the effluent is dried to a powder. Likewise, there remain potentially useful products dissolved in the fluid that is now discarded after

It's incredible!
...the commodities
that go into a

bag

Polystyrene—Feeds—Calcium Chloride—Salt—Ammonium Nitrate—Cement—Rosin—Fertilizers—Sugar—Flour
—Insecticides—Fine Chemicals—Clays—Rock Wool—and over 400 other products costing from less than a cent
u pound to over a dollar a pound are being packed in Bagpak Multiwall Paper Bags.

Support office furnished Deg Opering Electrical, For details at the begin and most lives with 10 European Airiston
American Paper Company, 220 Sept 42nd 25, New York 17, Dept. 5-7.



MBANCH CHRICES: Arlanto - Bathmore - Marker Springs, Koesaa - Boahan Chicaga - Clevaland - Denver - Detroit - Koesses City, Koesaa - Los Angeles New Cricans - Philadelphia - Pittsburgh - St. Loets - Son Frencisco - RN CANADA: The Continental Paper Products, Itd., Montreal, Ottawa, Toronto Paper .....

BAGPAK DIVISION

### CATSUP FOR A BILLION HAMBURGERS

# Quality Controlled

WITH NEPTUNE METERS



The G. S. Suppiger Company makes 30,000,000 bottles of Brooks catsup a year -catsup with a carefully controlled "tangy" flavor - not sweet - not biting - but "just right." Accurate measurement of liquid sugar and other liquid ingredients is vital -accurate measurement delivered to batch after batch by the fine-instrument precision of the three Neptune Meters shown above.

In plant after plant Neptune Meters are the key to quality control. They pay for themselves by eliminating spoilage, spillage, and the unsanitary muss and fuss of gauge sticks, pails or batch tanks. Use them for accurate cost accounting and inventory control, too. Positive displacement type, simple in design, quality built for sustained accuracy. Many types available for handling over a hundred different industrial liquids.

NEPTUNE METER COMPANY 50 WEST 50th STREET . NEW YORK 20, N. Y.

Branch Offices

ATLANTA - BOSTON - CHICAGO - DALIAS - DENVER - LOS ANGELES LOUISVILLE - NORTH KANSAS CITY, MISSOURI - PHILADELPHIA - SAN FRANCISCO - PORTLAND, ORE. - Conodion Foctory: TORONTO 14, ONT.

# **NEW** DATA ON LIQUID METERING

New bulletin tells you how to select the right meters for your process. Covers meters for handling more than 100 industrial liquids-hot or cold water, oils, syrups, brines, soap solutions, scores of chemical solutions, etc. Shows meters from %" to 6"from simple horizontal straightreaders to the newest 432 Auto-Stop automatic batching meters. A gold mine of information for processing engineers!

#### Get Started Now!

Write for it-it's free. Ask for it



News, cont. . .

sulphite liquor has been treated by the torula yeast process.

To explore these possibilities the League has installed a vacuum drum dryer of commercial type but specially designed for pilot plant and laboratory volume and precision service.

Primary purpose of this unit is to prepare dried samples of byproduct materials for further research by the League and by such potential bigvolume users as the principal pharmaceutical manufacturers. The equipment will also be used to dry research samples of materials submitted by the 14 sulphite mills that jointly support the League's research.

Bulk Plasticizers: A new bulk station, recently opened at Perth Amboy, N. J., by Monsanto Chemical Co., will deliver plasticizers to customers in the New York area by compartmented tank truck. It's the company's third bulk station. Others are at Everett, Mass., and St. Louis, Mo., and a fourth is building at Akron, Ohio. Their purpose: to bring a wide range of Monsanto plasticizers to users for compounding versatility, and at tank truck

Fresh Water From Sea: The House has agreed to a Senate version of a bill authorizing \$2 million for a study of plans to change sea water into usable fresh water. The House action sends the bill to the White House.

Jet Fuels: Phillips Petroleum Co. will operate the Bluebonnet ordnance plant at McGregor, Tex., where it will produce "Jato" units that provide jet power to assist aircraft takeoffs. Phillips has organized a rocket fuels division in its research and development department.

Filtration-Extraction: A filtration-extraction process for recovering oil from cottonseed, rice brand and other oil seeds is now offered by the Chemical Plants Division of Blaw-Knox Co. Particularly suited to the needs of the small cottonseed processor, the process utilizes conventional equipment for linting, hulling, rolling and cooking, uses a horizontal rotary vacuum filter, and provides the advantages of direct solvent extraction of a variety of oil

-F.nd



# DIDE WATER

#### DISTILLED WATER OF LABORATORY QUALITY

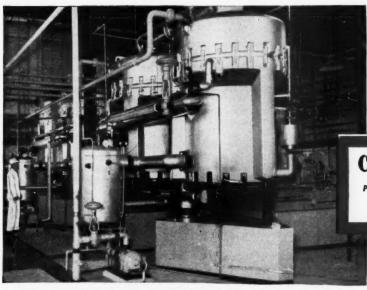
- e for Pharmacoutical Noods
- a for Chemical Processing
- e for Potable Water Supply

# ... At Lowest Cost with Cleaver-Brooks Compression Stills

WHEREVER water is needed — in quantity and quality — a Cleaver-Brooks Compression Still provides the most effective and the most economical method of water purification.

Potable water can be produced using a nearby source of brackish water or sea water, thus eliminating the need for pipe lines, trucking or barging facilities from a remote water source. Where potable water is already available, but processing requirement demand chemically pure water, a Cleaver-Brooks Compression Still provides a USP chemically pure, pyrogen free water — far exceeding the high standards required for pharmaceutical preparations or chemical processing.

Cleaver-Brooks Compression Stills are available in standard size from 85 gph to 2800 gph motor, engine, or turbine driven.



Cleaver-Brooks Compression Stills at Arrowhead & Puritas Waters, Inc., Los Angeles, Cal. This plant is one of the largest compression still installations in the world, producing over 100,000 gals. of pure water daily.



Write for latest bulletin, "Compression Distillation," Cleaver-Brooks Company, Dept. K—250 No. Grand Ave. Waukesha, Wis.

## **Cleaver-Brooks**

Pioneers in the development of ompression distillation

Builders of Equipment for the Generation and Utilization of Heat Steam Boilers • Oil and Bitumen Tank-Car Heaters • Distillation Equipment • Oil and Gas-Fired Conversion Burners

# Readers' Views & Comments

#### **Novel Man-Hour Estimator**

Sir:

I was intrigued by H. E. Wessel's graph and article in your July issue (p. 209) on how to estimate the manhours of operating labor per ton of product for any process . . . I think it is the most novel approach to the subject I've ever seen.

You may be interested to know that I checked some of Mr. Wessel's data against actual plant figures . . . and found his method remarkably accurate for quick estimating purposes.

F. D. Brown

#### Chemical Engineer Wilmington, Del.

► The novel graphical method Reader Brown refers to correlates operating labor in man-hours per ton per processing step against the size of the plant in tons of product per day-without regard to the particular process!-En.

#### New Chemical Process

Sir:

I am taking this opportunity to congratulate you and your entire editorial staff for the presentation made in your article "Chemical Refining of Metals" in the June issue of Chemi-

cal Engineering (p. 164).
In tracing the history of the Chemico technique from its inception to the present stage of development, Mr. O'Connor's article gives us a clear-cut perspective not only of what the process can mean technically and economically, but gives us an insight as to what it can mean in our future society as well.

WILLIAM M. HAYDEN

President Chemetals Corp New York, N. Y.

As we see it, the brand new-and unorthodox-Chemico technique for treating ores and recovering metals may well pan out to be one of the most significant chemical process developments in recent years. It is a refreshing example of what chemical engineers can do in other fields.

Our story was the result of the dogged diggings of Editor O'Connor. For close to two months he left no stone unturned in his efforts to dig out a new fact on the process or a fresh facet on its significance.

Joe's comment when I showed him the poes comment when I showed him the telephone bill: "You can get a lot of information with \$207 worth of long-distance telephone calls!"—Ep.

#### TO CHARTS Corrosive 300 ....... -----200 30.3% H,SO., 12.3% H,O — liquid and vapor 100 Airobal Ethyl Alcohol Mathy 50 75 Less than 0.02 ipy. for all Less than 0.02 ipy, for all Concentration,% Resistant = A = < 0002 in per yr. ● = < 0.02 in per yr. = 0.02 - 0.05 ipy. Attacked a V > 0.05 in. per yr. an 0.02 ipy. for

## **Corrosion Charts Analyzed**

Last December we started a new series of charts to give corrosion data for specific materials of construction vs. a number of corrosives. Here's how they're going over.

#### Up to 205 Corrosives

The response here to your new Corrosion Forum series and the method of presentation has been unanimously enthusiastic. Especially liked were the unusually large number of corrosives covered.

I did find in a few instances some confusion in interpretation of the charts. However, in each case the confusion resulted from failure to read the text first and to understand the inherent limitations of the charts.

Perhaps I sound a little cynical, but I have noticed in the past few years too great a tendency on the part of young, less experienced engineers, especially those just out of school, to expect to find in the literature or handbooks, precise, quantitative and definite answers to their particular problems and a reluctance to go back to basic chemical and physical principles to develop sound and logical solutions.

For this reason, perhaps a little more emphasis on the qualitative and screening nature of the series would be in order.

Another suggestion, and I make it with the full realization of the work involved, is that more points be included in each chart. The more points there are on each chart the more value it will be to more people.

You and your magazine are to be congratulated for initiating this series and particular method of presentation. If subsequent articles in the proposed series are as comprehensive and usable as the first, the series will be a valuable contribution to the corrosion and materials of construction field.

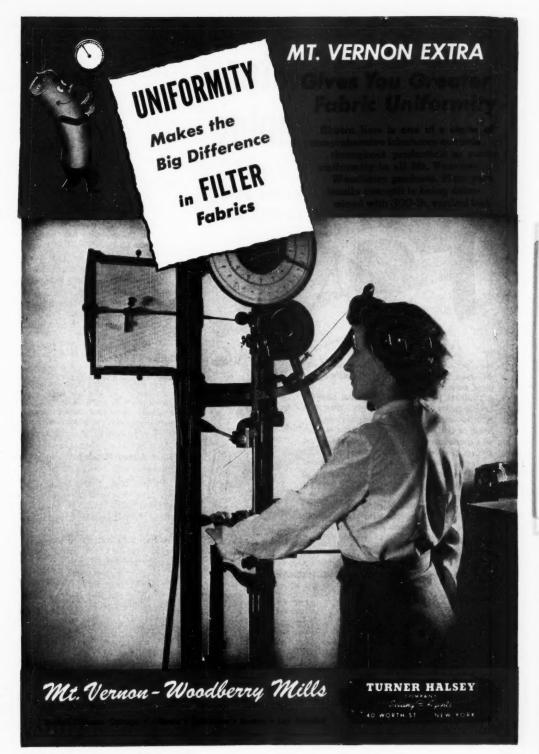
Although I clip each article and chart as it appears, I hope you are planning to issue a combined reprint of the entire series, perhaps in booklet

form.

J. B. Scott

Superintendent & Chief Engineer Adams Terminal Plant Phillips Chemical Co. Pasadena, Texas

Reader Scott here points out several ways we can make our Corrosion Forum





\$, BLICKMAN, Inc., 609 GREGORY AVE., WEEHAWKEN, N. J.



READERS' VIEWS, cont. . .

charts more useful; we're now working on all of them. Like Mr. Verink, he stresses the value of the charts for qualitative and screening purposes.

We estimate the series will run for more than two years. When it is completed, we will probably make the entire series available as a booklet. Meanwhile, we are making each month's chart available in reprint form.

For some of Mr. Scott's own bouts with corrosion in his plant, see his article "How to Protect Your Steel" (Chem. Eng., April 1951, p. 135).—Ep.

#### Swell . . . But

Sir.

Your new-type Corrosion Forum is swell . . . I especially like the charts. They are the best I've seen for presenting corrosion data to the average chemical engineer in the form of a simple, clear, usable guide.

But I have one big gripe. I clip and save each month's charts, and I find it annoying to have them "strung out" through pages of ads.

Can you do anything to consolidate

E. W. THOMAS

Chemical Engineer Los Angeles, Calif.

▶Yes, and we have. Reader Thomas and others of you who have taken us to task on this score will now find most of the charts consolidated on full editorial pages. This makes them more convenient to clip and file.—ED.

#### What About Metals?

Si

By and large, the technique that you have developed appears to be quite attractive and, in situations where the relationships between the materials rated and the factors that influence their behavior in service are not too involved, your tables should be quite useful and easy to use.

However, when it comes to most of the metallic materials of construction, I am afraid that their performance is likely to be influenced so much by impurities likely to be present in the chemicals and effects of aeration, velocity and temperature that it will be impractical to cover the matter adequately in any such simple form as your proposed charts.

In this connection, I am inclined to refer you to a discussion of this subject which formed part of a lecture entitled "Corrosion Tests and Service Performance" which was included in an A.S.M. publication entitled "Interpretation of Tests and Correlation with Service" issued in 1951.

F. L. LAQUE

Head, Corrosion Engineering Section Development & Research Div. International Nickel Co., Inc. New York, N. Y.

►We certainly appreciate the difficulty and dangers—Mr. LaQue points out; they actually caused us to hesitate some time before initiating the series.

But we believe we have now overcome this through using brief footnotes or "flags" on each chart as well as calling attention to unusual conditions or limitations in the text itself.

And here, again, we caution our readers that the charts—like most published corrosion data—are most useful for "preliminary screening."

For final selection, there is no substitute for experience, the expert advice of materials of construction suppliers and in many cases your own testing program.—En.

#### Use Them Properly

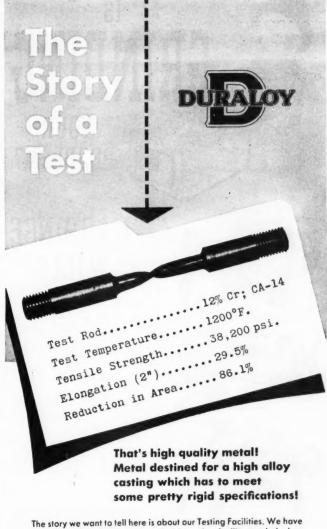
Sir-

Most of the listed solutions in the charts are supposedly pure. But when they are pumped in industry other liquids and solids are present, which may act as accelerators or inhibitors. In fact, more complex mixtures are handled in the chemical and process industries than are pure solutions. Hence, a chart of this nature can serve as a rough guide, as you clearly state, but many of the plant men who would use such a chart are not too inclined to take into account the differences between a pure solution and one that contains "impurities."

The presence of an impurity could act as an accelerator of corrosion with one type of metal and an inhibitor with another type. Thus, a trace of nitric acid or chromate in H<sub>2</sub>SO<sub>4</sub> could increase the corrosion rate on Monel a thousand fold but reduce the corrosion rate on a nickel-chrome alloy; or the presence or absence of air could cause radically different results on different alloys.

The question of differential corrosion cells is important. Velocity is the cause of great variables. Thus, a copper or bronze disc revolved in sea water will corrode most at the perriphery, while similar cast iron discs under similar conditions will corrode most near the center.

Thus, you can understand why I have little confidence in the actual



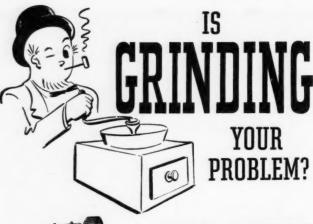
The story we want to tell here is about our Testing Facilities. We have right in our foundry every conceivable testing facility needed when checking static or centrifugal high alloy castings for industry. Where required, we make complete chemical, metallurgical, and mechanical checks and tests. And have both a 400,000 volt X-ray unit and gamma-ray unit, for checking the final casting for hidden flaws.

As we see it, the only way to assure customers of high quality castings is to have and use all necessary facilities for testing and checking the heat, pour and finished casting.

# THE DUKALUY COMPANY

Office and Plant Scottagle, Pa. Lastern Office 12 Last 41st 5 treet, New 1018 17, N. 1
Detroit Office: 23905 Woodward Avenue - Pleasant Ridge, Mich. \*

Allender J. M. TULL Caleage: E. O. HELSON San Francisco. IOHN D. FENSTERMACHE.
Metal & Supply Co. BDS. S. Mahlagan Arestuse
METAL COORS CORP. Dailor. • Denore: • Mouston • Kansas. City • New Orleans. • St. Louis. • J.





CONICAL MILLS



ROD MILLS



TRICONE MILLS



TUBE & CYLINDRICAL MILLS

# HARDINGE

#### CONICAL MILLS

—The Hardinge Conical Ball (or Pebble)
Mil Is unequaled in efficiency. Grinds wet
or dry, in open or closed circuit. Our-standing feature: natural size segregation
or grinding medis, from feed to discharge.
Bulletin 17-B-11 for dry grinding; Bulletin
AN-399-11 for wet grinding

#### TRICONE MILLS

—Same ball segregation effect as obtained in the Conical Mill, plus additional grind-ing volume. Ideal for large capacity oper-ations. Bulletin AH-414-11,

#### ROD MILLS

--Ideal for producing minimum oversize in open circuit grinding. Grinds either wet or dry. Convex heads reduce friction, prevent congestion of charge at the ends, and align the rods. Bulletin 25-B-11.

#### TUBE MILLS

—For a fine product in open circuit with-out the use of classifiers. For mixing and grinding to secure a smooth texture or plastic product. Bulletin 18-B-11.

#### CYLINDRICAL MILLS

—The Cylindrical Ball (or Pebble) Mills have demountable trunnions, and convex heads to reduce head liner wear and in-crease mixing action. Supplied with or without grates, as required. Bulletin AH-389-11.

COR

YORK, PENNSYLVANIA-240 Arch St. Main Office and Works NEW YORK 17 • SAN FRANCISCO 11 • CHICAGO 6 • HIBBING, MINN. • TORONTO 1 122 E. 42nd St. 24 California St. 205 W. Wacker Dr. 2016 First Ave. 200 Bay St.

READERS' VIEWS, cont. . .

value of corrosion charts to a troubleshooting corrosion engineer. However, I believe that your charts will have value for Chemical Engineering readers if they will use them properly. W. E. PRATT

Chemical Consultant Centrifugal Pump Div. Worthington Corp. Harrison, N. J.

► We are glad to pass along Mr. Pratt's practical advice and his warning about taking into account the difference between a pure solution and one that contains impurities.

We have, in fact, encouraged our con-tributors to include data on actual in-stream or commercial corrosives whenever possible. Some of our recent charts-such as those on Hastelloys in our June, July and August issues-have data on a number of such corrosives .- ED.

#### To Narrow the Field

The program on which you have embarked is an ambitious one. It would be unfair to pass final judgment on the project until all the sections have been published. As with all things, projects of this sort have both advantages and disadvantages.

Properly used, the corrosion data contained in your new series of articles should result in considerable saving of time for engineers concerned with material selection. Although it may not be possible to decide which material should be used for a specific service, the corrosion data charts should help narrow the field so that a final selection may be made more quickly and more economically.

On the other hand, there always is the danger that someone inexperienced in the field may overlook certain important features of a particular problem and thus mis-apply the information.

Often the suppliers of construction materials are in a position to offer substantial assistance to potential users of their products. I would suggest the use of the corrosion data charts to narrow the field, then contact suppliers for specific information.

ELLIS D. VERINK, JR. Head, Chemical Section Development Division Aluminum Co. of America New Kensington, Pa.

Mr. Verink has put his finger on a point we stress: Beware of picking your material



# SEEF TUBES DIVISION **ELECTRUNITE TUBING**

And you'd scarcely believe the improvements we've made in welded steel tubing since 1902.

Over 30 years ago, the famous ELECTRUNITE process of electric welding replaced the old-fashioned brazed and gas-welded methods. Today, every foot of length, every inch of circumference in an ELECTRUNITE tubular product is equally strong, equally resistant to corrosion, equally smooth and round.

We've improved techniques and added many products to the ELECTRUNITE line, too. At right you'll see examples of all the products we make at our big, modern plants in Cleveland and Elyria, Ohio, Brooklyn, New York, and Ferndale, Michigan.

ELECTRUNITE tubular steel products help many industries make things stronger . . . or lighter to move . . . or attractive longer . . . or safer . . . and at lower cost.

These first 50 years are only a start on new and wonderful developments in ELECTRUNITE Stainless and Carbon Tubing for mechanical and pressure applications,"Inch-Marked®" E.M.T. and Conduit for electrical installations.



"Inch-Marked" E.M.T... **Electrical Metallic Tubing** . light, strong steel tubing raceway to protect electrical wires against fire, moisture, and impact.



"Dekoron-Coated" E.M.T. for complete, longer-lived protection of wires in highly corrosive atmos-



Rigid Conduit . . . heavywall steel protection for wires in explosive and hazardous focations.

Tubing...made in a wide range of grades, sizes, and wall thicknesses to make all types of products lighter, stronger.



Stainless Steel Tubing and Pipe in a full range of sizes, types and wall thicknesses for chemical and food processing equipment, and mechan ical applications.



Heat Exchanger Tubes both carbon and stainless steel, for all types of heat exchangers, condensers, process equipment, and heaters.



Boiler Tubes for large boilers or small, high pressures or low.

REPUBLIC STEEL CORPORATION STEEL AND TUBES DIVISION 224 EAST 131st STREET . CLEVELAND 8, OHIO ELECTRUNITE E.M.T.



WILLSON PRODUCTS, Inc., 106 Thorn Street, Reading, Pennsylvania

See your WILLSON distributor or write for catalog

READERS' VIEWS, cont. . .

of construction without first consulting the manufacturers — unless you have already made extensive tests with your own plant in-stream corrosives.

Prime purpose of our charts is to "help narrow the field so that a final selection may be made more quickly and more economically."

That, to our way of thinking, is the greatest need of the average chemical engineer who is often called upon to select construction materials but who isn't a specialist in corrosion engineering.—ED.

#### What About the Shape?

Sir

We are extremely interested in your August report on "Size Reduction" (p. 151) since our business is the crushing and grading of abrasives.

Our problems are, of course, to crush to size but also to obtain definite shapes of particles at the desired size. We find that many manufacturers can help us to obtain the desired sizes but ordinarily can offer little assistance concerning the shape produced.

Would it be possible to include a future article that would comment on shape of particles in conjunction with size reduction?

R. C. HESSELBART

Manager Mid-West Abrasive Co. Owosso, Mich.

▶ Reader Hesselbart has put his finger on a tough problem. Do any of our readers care to pass along their tips and comments on how to grind to shape as well as to size?—Ep.

#### Four-Not Two-for Aromatics

Sir:

We refer to an article entitled "Platforming and Udex" which appeared in Chemical Engineering in May (pp. 242-245). There appears a sentence which states that the "Principal methods for separating the product so obtained include adsorption followed by fractional desorption (Arosorb process) and solvent extraction (Udex process)."

We appreciate that your primary interest may well lie in the news-worthiness of these two processes but we are sure that it is not your intent to leave with the reader a misconception as to the relative merits of all the processes existing in the field of aromatics recovery.

In addition to the Arosorb and

Udex processes there are in commercial operation the SO<sub>r</sub>-solvent extraction process employed by Humble Oil & Refining Co. and the Shell aromatics recovery process employing extractive distillation.

The Shell process was the first utilized in this field, the first plant going into operation in 1940, and it was the most extensively used process during the war years. Of the 15 plants in operation during that period for the recovery of toluene from petroleum sources, 11 used the Shell process. This represented approximately half of the total toluene capacity. The first recovery of petroleum benzene, in the postwar years, was in a plant employing this process converted to this purpose.

There are presently in operation four extractive distillation units, and three additional plants for benzene recovery are known to be under construction. Two of these are among the largest installations in the country.

While the SO<sub>e</sub>-solvent extraction process is less well known to us, we believe that the Humble unit represents the largest single aromatics recovery plant in the U. S. Conoco has also adopted this process for their new Lake Charles plant.

While the Udex and Arosorb processes are certainly active in this field and possess the merits you ascribe to them, we believe you will recognize that a statement representing them as the "principal methods for separating the products" is lacking in accuracy.

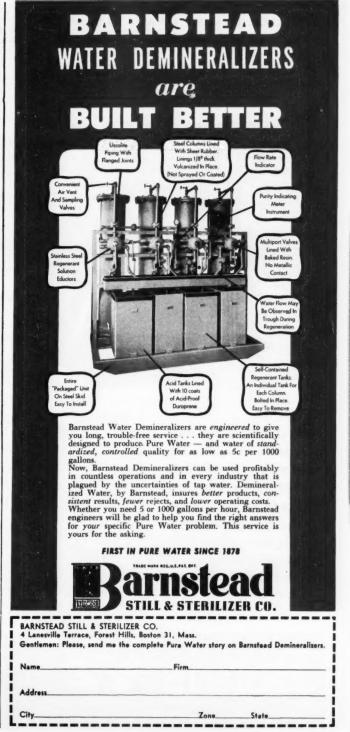
The extractive distillation process employing phenol as the solvent remains the only commercially demonstrated means for recovery of aromatics of nitration grade quality. Our data indicate that a greater volume of the aromatics (now in production or designed for) derived from petroleum is produced in plants employing this process as compared with any other process.

H. E. RANDLETT

Shell Development Co. New York, N. Y.

► We appreciate this additional information on the commercial processes for recovering aromatics, regret our slip in not mentioning the SO₂-solvent extraction and Shell extractive distillation processes. Our May article, of course, was principally a pictured flowsheet of the new Platformer-Udex setup of Eastern States Petroleum Co. at Houston.

For the present status of Shell's extractive distillation process in recovering ben-



HELLO...BEMIS? I WANT TO ORDER A
CARLOAD OF MULTIWALLS. WHEN DO
YOU THINK... OH! HERE THEY ARE!
WHAT TOOK YOU SO LONG?



Don't pin us down to that, please. But, no fooling, the twelve Bemis multiwall plants, strategically located coast to coast, mean that at least one is conveniently close to you. This time-saving means moneysaving. Ask your Bemis Man for details.



Bemis



General Offices — St. Louis 2, Mo. Offices in all Principal Cities READERS' VIEWS, cont. . .

zene from petroleum aromatics, see our story "Boost for Petrobenzene" in June, p. 262.—Ep.

#### Mexico Before U. S.

Sir:

With regard to the recent item on the flash drying of starch, the statement that the American Maize-Products plant is the first to use this process should be qualified and limited to the United States.

The Corn Products Mexican subsidiary, located in Guadalajara, Mexico, has been using the flash drying process on corn starch since 1948 or early 1949. I visited this plant in November, 1949, and it had been operating for some time.

WALTER J. ARMSTRONG International Bank for Reconstruction & Development Washington, D. C.

► We appreciate this additional bit of information on the history of flash drying in the starch industry. For more background on flash and rotary-flash drying of starch, see p. 288 of our June issue.—ED.

#### -LITTLE BONER-

#### Just Take Out the Sulphur

Several years ago a large chemical company had an executive who was a financial wizard. But on technical matters he was on the yonder side of ignorance.

One day he got an idea on how the firm could make a neat pile of money: recover elemental sulphur from certain metal sulphides that were abundant and cheap.

Now this executive never doubted the value of his ideas, and he didn't tolerate back-talk, either.

So he had the company set up a research program. After all, it was his idea. But after a year or so he began to get impatient; he never could understand why researchers puttered around so much, anyway.

One day, when he was touring the company's research lab, he came to one poor fellow and demanded: "Tell me, what are you playing around with?"

"Iron sulphide."

"That's iron and sulphur, isn't it? Well, dammit, take out the iron and you have sulphur left, don't you? What's so hard about that?"

This company threw thousands of dollars down the drain before somebody stood up and told the executive his pet idea simply wasn't sound. Moral to this tidea simply wasn't sound on't know anything the sound of the

### at DAN RIVER MILLS

one of the world's largest single unit textile plants -



#### JENKINS VALVES are standard equipment

Dan River Mills' slogan is "First in Fashion — Foremost in Research". In applying modern methods to the development of better fabrics, Dan River engineers must necessarily maintain the highest efficiency in all mill operations, from fiber preparation to fabric finishing. This, in turn, dictates an exacting selection of all operating equipment.

The decision to standardize on Jenkins Valves was made only after careful comparison of performance in all types of services, and of maintenance expense. This confidence in the extra measure of efficiency and economy provided by Jenkins Valves is shared by plant operating managements in every type of industry.

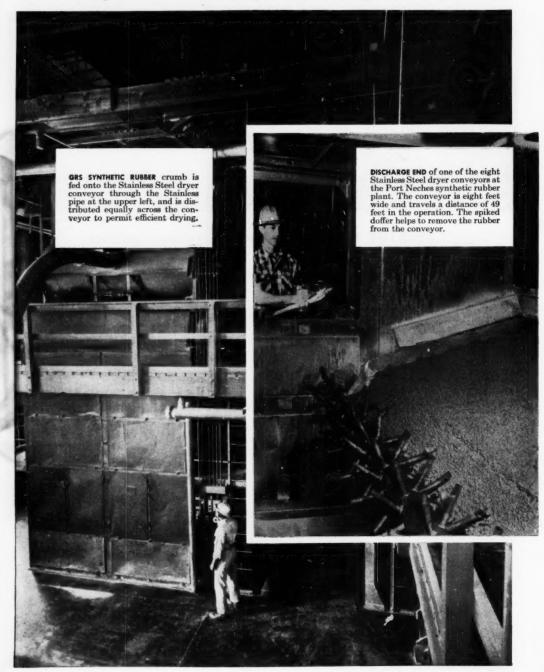
Despite this extra value, you pay no more for Jenkins Valves. For new installations, for all replacements, let the Jenkins Diamond be your guide to lasting valve economy. Jenkins Bros., 100 Park Ave., New York 17. Jenkins Bros., Ltd., Montreal.



■ In Dan River Mills' 100 acres of floor space, a vast network of pipelines requires all types of bronze, iron, and stainless steel valves for control of steam, water, air and sanitation. Jenkins Iron Valves controlling steam supply to finishing equipment are shown here.

JENKINS
VALVES

# For protection against high humidity,



# salt and acid

#### SYNTHETIC RUBBER CRUMB IS NOW DRIED ON

# Stainless Steel ...

. CONVEIORS



When the Government's synthetic rubber plant at Port Neches, Tex., was reactivated two years ago, the operator, Naugatuck Chemical Division, United States Rubber Company, solved the twin problems of corrosion and product contamination in drying operations by replacing existing black iron conveyors with corrosion-resistant U·S·S Stainless Steel.

As wet crude rubber leaves the filter, it contains about 30% water, plus some sulphuric acid and salt not removed by washing. The conveyors carry it into ovens—held at 175°F. This high humidity, salt and acid are highly conducive to corrosion.

Stainless Steel has exceptional resistance to the acid and salts in tLis service. There's no chance of contamination of the finished crude rubber. And the Stainless Steel conveyors can be cleaned more easily and more efficiently.

The service life of the black iron conveyors formerly used was between two and three years. Plant officials expect at least five more years of life from Stainless Steel. The present conveyors have been in operation 126 hours per week over a two year period with no maintenance problems.

The characteristics demonstrated by U.S.S Stainless Steel in this application—excellent corrosion resistance under severe conditions, long life, freedom from product contamination and ease of cleaning—make it the ideal material for many types of chemical processing equipment. While the initial cost of Stainless equipment may be higher, its performance makes it far less expensive in the long run.

Our representatives will be glad to discuss the various grades of U-S'S Stainless Steel with you in terms of your applications. When your equipment is fabricated from U-S'S Stainless Steel, you can count on the finest performance.

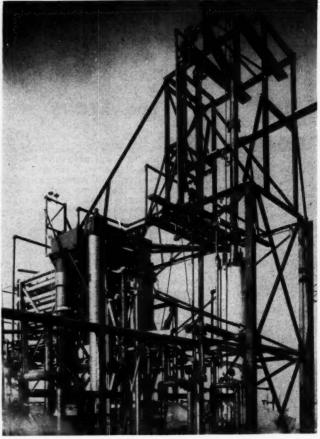
UNITED STATES STEEL COMPANY, PITTSBURGH • AMERICAN STEEL & WIRE DIVISION, CLEVELAND • COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO
NATIONAL TUBE DIVISION, PITTSBURGH • TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA. • UNITED STATES STEEL SUPPLY DIVISION, WAREHOUSE DISTRIBUTORS
UNITED STATES STEEL AFFORD COMPANY, INC. YORK

# U·S·S STAINLESS STEEL

SHEETS . STRIP . PLATES . BARS . BILLETS . PIPE . TUBES . WIRE . SPECIAL SECTIONS



UNITED STATES STEEL



Extensive use of carbon and graphite at Tennessee Products and Chemical Corp.

## Carbon and Graphite

The corrosion resistance of carbon and graphite as well as impervious carbon and graphite, with data on physical properties, forms available and applications.

J. P. OLIVER National Carbon Co., a Division of Union Carbide and Carbon Corp.

Corrosion-resistance properties of carbon and graphite, together with the economy and flexibility of operation which they afford, have led to their widespread use as construction materials in the chemical industry. These materials in their regular form

are slightly porous and not entirely impermeable to fluids. Chemically inactive, they resist the action of most acids, alkalis, organic compounds and other chemicals not characterized as strong oxidizing agents. Light weight is combined with reasonable strength.

Machinability of these materials, particularly graphite, permits production of a large variety of shapes and sizes for easy fabrication. They are practically immune to thermal shock because of their low coefficient of expansion. Since carbon is a relatively good thermal insulator while graphite is a better conductor of heat than many metals, a wide range of thermal conductivity is provided. Threshold oxidation temperatures of commercial carbon and graphite in air are 660 and 750 deg. F. respectively, but both are stable in non-oxidizing atmospheres up to their volatilization point of approximately 6,600 deg. F. Carbon volatilizes without melting at ordinary pressures. Typical physical properties of carbon and graphite products are given in Table I.

For many chemical process applications, the base stocks are made impervious by impregnating them with chemically resistant, thermosetting synthetic resins. Base material strength is increased considerably by selection of the proper type of resin impregnant, and the impervious forms may be utilized in practically all chemical conditions where the base materials are resistant. Graphite is used almost exclusively as a base stock for manufacturing impervious materials because of its good machinability combined with its high thermal conductivity. Forms in which carbon, graphite, and impervious carbon and graphite are available and the applications are shown in Table II. Equipment constructed from these materials is used in the process industries manufacturing pulp and paper, foods, soaps, petroleum derivatives, synthetic fibers, acids, alkalis, bleaches, salts, organic chemicals as well as those doing metal pickling and plating.

General chemical-resistance properties of carbon and graphite are shown in Table III. Chemical-resistance properties of impervious carbon and graphite at various temperatures and concentrations, together with resinbase cements recommended for fabrication are shown in the charts on the following pages. The symbols on the charts are to be interpreted as

Triangle-Recommended for tem-



- . PHYSICAL PROPERTIES
- . AVAILABLE SIZES
- . TYPES OF CONNECTIONS
- . STANDARD FITTINGS
- a REDUCED FITTINGS
- . PIPING ACCESSORIES
- . HAND THREADING
  - AND SERRATING TOOLS
- . DESIGN DATA
- . INSTALLATION
- . OPERATION
- ORDERING INFORMATION

Here's the "BOOK" on "Karbate" impervious graphite pipe and fittings—profusely illustrated... simply and fully covered under the subjects listed above. Add to your knowledge of this singular line of products which is rapidly becoming a preferred standard throughout the chemical processing, petrochemical and petroleum industries. Send for your free copy of this 16 page CATALOG SECTION S-7000.



#### **DOLLARS** and SENSE . . .

point to "Eveready" No. 1050 Industrial Flashlight Batteries . . . the cells that deliver twice as much usable light as any battery we've ever made before. Their urique construction prevents swelling or jamming in the case . . . has no metal can to leak or corrode.

OTHER NATIONAL CARBON PRODUCTS

The terms "Karbate" and "Everendy" are registered trade-marks of Union Carbide and Carbon Corporation

# NATIONAL CARBON COMPANY A Division of Union Carbide and Carbon Corporation 30 East 42ed Street, New York 17, N. Y.

District Sales Offices: Atlanta, Chicago, Dalles, Kansas City, New York, Pittsburgh, San Francisco

IN CANADA:
National Carbon Limited, Montresl, Toronto, Winnipeg

HEAT EXCHANGERS . PUMPS . VALVES . PIPING . TOWERS . TOWER PACKING . BUBBLE CAPS . BRICK . STRUCTURAL CARBON . SULPHURIC ACID CUTTERS . HYDROCHLORIC ACID ABSORBERS

For textile mills, and and

LEADING ENGINEERS CHOOSE SARAN RUBBER-LINED PI pipeline corresson, MICHIGAN SARAN RUBBER-LINED 6110 STEEL PIPE rs the ive chemicals, oils, acids and gases. Available in fabricated teel or standol pipe in Mar 10' and 20' lengths ranging in size from 8" up...or fabricated.

For additional information write to your MPC representative or to our Application Engineering Dept.

exact requirements.

\*Saran Rubber is a development of the Dow Chemical Company



#### Corrosion Forum, cont. . .

peratures and concentrations as shown. Unless otherwise noted use is satisfactory at all concentrations below maximum shown.

Circle-Generally satisfactory but limited service life.

Inverted triangle-Unsatisfactory. Not recommended.

Footnotes to charts indicate special conditions to be observed. First number in the lower left-hand corner of each chart indicates the grade of impervious graphite recommended. The letter (A or B) indicates the grade of cement recommended for fabrication. These are arbitrary designations as used here, and corresponding compositions are noted in Table V.

These charts do not lend themselves to representation of corrosion resistance of mixtures. However, mixtures of any of the chemicals listed may be handled within the limits indicated except where such mixtures result in solutions highly oxidizing in character. For aerated solutions the information as shown may be used, aeration of a solution having no effect on impervious carbon or graphite or the cements used with them.

TABLE I-Typical Physical Properties of Carbon and Graphite Products \*

	Plain Carbon	Plain Graphite	Impervious Carbon	Impervious Graphite	Carbon	Porous Graphite
Apparent density, lb./cu. ft. Strength, lb./so. in.	98	97	110	117	65	65
Tensile. Compressive. Transverse.	2,600-9,000	900 4,500-5,000 2,800	1,800 10,000 4,400	2,500 9,000 4,700	80-190 300-850 160-600	50-110 270-500 140-250 0.0012-0.0020
Mean coefficient of thermal expansion (70° F.—212° F.)	0.0015-0.0020	0.00034-0.00042	0.0016	0.00034	0.007~0.008	
× 10 <sup>-7</sup> per °F	13	10-16	29	24	25-26	20
Thermal conductvity, Btu./(hr.)(aq. ft)(°F./ft.).	3-3.5	70-86	3	86	1-1.5	20-50

#### Table II-Forms, Applications, Fabrication °

Forms . . . CARBON—Brick, bars, plates, powder, rods, beams, blocks, cylinders, extruded and molded shapes, pipe, raschig rings,

and moided shapes, pipe, rasenig rings, machined shapes.
GRAPHITE—Brick, bars, plates, powder, rods, beams, blocks, cylinders, extruded and moided shapes, pipe, machined shapes.
IMPERVIOUS CARBON AND GRAPHITE—Brick, beams, bars, plates, pipe and fittings, tower sections, machined and fabricated items.

Fabrication . . .

CARBON AND GRAPHITE—Cementing with resinous, carbonaceous, silicate base, etc. cements and machining.

IMPERVIOUS CARBON AND GRAPHITE—Cementing with resinous cements, conventional methods of assembling pipes and fittings, etc.

#### Table IV-Domestic Manufacturers

British-American Carbon Co.†
New York, N. Y.
Falls Industries, Inc.†
Solon, Ohio
Great Lakes Carbon Co.
Chicago, Ill.
International Graphite & Electrode Corp.
St. Mary's, Pa.
National Carbon Co.†
New York, N. Y.
Speer Carbon Co.
St. Mary's, Pa.
Stackpole Carbon Co.
St. Mary's, Pa.

† Also manufactures impervious carbon and impervious graphite.

#### Table III-General Chemical Resistance

Acids . . . CARBON AND GRAPHITE—Inert in all con-centrations and phases except those of oxidizing character such as oleum, chromic, aqua regia, etc.

CARBON AND GRAPHITE—Inert in all con-centrations and phases.

CARBON AND GRAPHITE-Inert in all concentrations at boiling temperatures ex-cept those of strong oxidizing character as acid solutions of K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub> and Na<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub>, permanganates, etc.

Permanganates, etc.

Halogens, Air, Water... halogens at all concentrations at boiling temperatures except strongly oxidizing aqueous solutions. Threshold oxidation temperature in air 660 deg. F. Threshold reaction temperature with water 1,110 deg. F.

GRAPHITE—Br., 100%, rapid disintegrations of the concentration of the c

Organics . . .

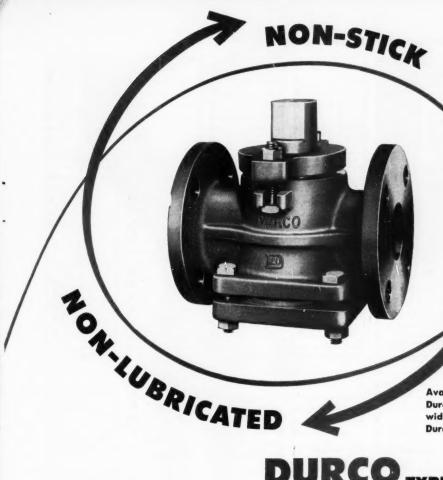
CARBON AND GRAPHITE—Inert in all at boiling temperatures.

#### Table V-Arbitrary Grade Designations \*

#### Impervious Carbon and Graphite Designation Base Stock Resin Impregnant Carbon Carbon Graphite Graphite Phenol-formaldehyde Modified phenolic Phenol-formaldehyde Modified phenolic

	Mesin Dase Cements
Designation	Composition
A	Acid catalyzed phenol-formaldehyd
R	Modified phanolic resin base

\*Impervious carbon and graphite as used here refer to products of National Carbon Co., a division of Union Carbide and Carbon Corp., which are marketed under the trade-mark "Karbate." Whereas resins used with these materials vary somewhat with the manufacturer, they are all thermosetting. In Table V, resin base cements indicated are the products of the same manufacturer.



Available in Durimet 20, Durco 18-8-5-Mo and a wide range of other Durco stainless alloys.

# DURCO TYPE F VALVE

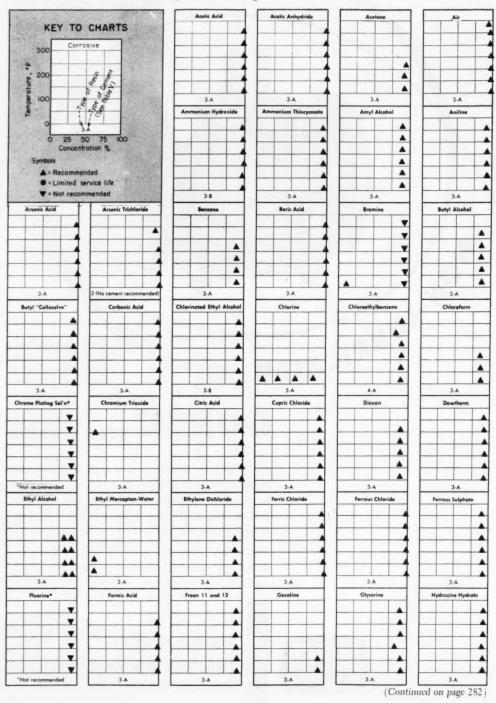
When you buy a valve, you're mainly interested in trouble-free performance. This valve gives it to you—in the toughest kinds of chemical service. There are thousands in use. Yet, no case of sticking has ever been reported, despite the fact that no lubricant is used.

The reason is the Teflon sleeve—and the basic design that makes it practical to use. Sizes  $\frac{1}{4}$ " through 2". Other details in Bulletin 647.



A product of THE DURIRON COMPANY, Inc. Dayton, Ohio

### Corrosion Resistance of Impervious Graphite





With a little planning you can help stretch out the nation's stainless supply - and get faster delivery of

Crucible will be glad to help you accomplish this. Our metallurgists and stainless fabricating specialists have a wealth of experience with stainless. They can help you select satisfactory grades and finishes more readily available than those you are now using. This will help ease the bottleneck on stainless and will enable

Call us today. We shall be glad to help you out.

first name in special purpose steels

52 years of Fine steelmaking

### STAINLESS STEEL

CRUCIBLE STEEL COMPANY OF AMERICA, GENERAL SALES OFFICES, OLIVER BUILDING, PITTSBURGH, PA. REZISTAL STAINLESS . REX HIGH SPEED . TOOL . ALLOY . MACHINERY . SPECIAL PURPOSE STEELS

### Corrosion Resistance of Impervious Graphite, cont. . . .

Hydrobromic Acid	Hydrochloric Acid	Hydrofluoric Acid	Hydrogen Sulphide-Water	ladine*	Isoprepyl Acetate
				▼	
		A AV		-	
	1	A A'			
	4	-			
				Y	
				V	
4	1				
1				1111	3-A
3-A	3-A	3-A	3-A	*Not recommended	
Isopropyl Alcohol	Isopropyl Ether	Karesane	Loctic Acid	Manganaus Sulphote	Mannitel
	1111				
			-		
			4	A	
A					
A					
A					
A					
3-A	3-A	3-A	3-A	3-A	3-A
				Moneethonolomine	Nickel Chloride
Methyl Alcohol	Methylisobutyl Ketone	Monochlor Benzene	Manachiaracetic Acid	moneempasamine	Televar Cilional
+++	A				
	<b>A</b>			1	
	A				
	A				
A	A		1	1	
<b>A</b>					
3-A	3-A	3-A	3-A	3 ("B" coment recommended for field assembly)	3-A
Nickel Sulphate	Nitric Acid	Nitric Acid*	Octyl Alcohol	Oleic Acid	Oxalic Acid
Nickel Sulphate	Prime Acid	THIRE ALLO			
				4	
-	A	A .			
A					
A	<b>A</b>			1	
	3 ("A" cement with threaded joints)	"As used with 5% HF 3-A (Use "A" cement with threaded joints)	3-A	3-A	3-A -
3-A	31 × cement with	threaded inints)	3-A	30	
	threaded joints)	missione joines			
Paradichlorbenzene	Paraldehyde	Phosphoric Acid	Phespherus Trichleride	Sedium Chloride	Sodium Hydrexida
Paradichlorbenzene			Phespherus Trichleride	Sodium Chloride	Sodium Hydraxida
Paradichlorisenzene			Phespherus Trichleride	Sodium Chloride	Sodium Hydrexide
Paradichlorbenzene			Phosphorus Trichloride	Sedium Chloride	Sedium Hydrexide
Porudichlorbenzene			Phosphorus Trichloride	Sedium Chloride	Sodium Hydrexide
Porudichlorbenzene			Phosphorus Trichloride	Sedium Chloride	Sedium Hydrexiel
Poradichlorbenzene			Phespharus Trichloride	Sedium Chloride	Sodium Hydrexide
Porudichlorbenzene			Phespherus Trichleride	Sedium Chloride	Sedium Hydrexide
Poradichlorisenzene			Phespherus Trichleride	Sedium Chloride	
	Parakéhyde	Phosphoric Acid	Phespherus Trichleride	Sodium Chlorida	Sodium Hydraxidi
3.8	Porsidehyde	Phosphoric Acid	3.4	3.4	48
3.8	Parakéhyde	Phosphoric Acid	•		4-8 Sulphuric Acid
3.8	Porsidehyde	Phosphoric Acid	3.4	3.4	4-8 Sulphuric Acid
3.8	Porsidehyde	Phosphoric Acid	3.4	3.4	4-B Sulphuric Acid
3.8 Sodium Hypochlorite	Porokdehyde	Phosphoric Acid	3.4	3.4	4-B Sulphuric Acid
3.8 Sodium Hypochlorite	Poroldehyde	Phosphoric Acid	3.4	3.4	4-B Sulphuric Acid
3.8 Sodium Hypochlorite	Porokdehyde	Phosphoric Acid	3.4	3.4	4-B Sulphuric Acid
3-8 Sodium Hypechlorite	Poroldehyde	Phosphoric Acid	3.4	3.4	4-B Sulphuric Acid
3-8 Sodium Hypochlorite	Porsidehyde	Phosphoric Acid	3.4	3.4	4-B Sulphuric Acid
3-8 Sodium Hypochlorite	Porsidehyde	Phosphoric Acid	3-A Stearic Acid	3-A Sulphur Monechloride	4-B Sulphuric Acid
3-8 Sodium Hypochlorite	Porsidehyde	Phosphoric Acid	3-A Stearic Acid	3-A Sulphur Manachlorida	3-A (Use "A" cement with threaded joints for conc. above 23 %)
3-8 Sodium Hypochlorite	Porsidehyde	Phosphoric Acid  3-A  Steam-Water	3-A Stearic Acid	3-A Sulphur Monechloride	3-A (Use "A" cement with threaded joints for conc. chopse 27 %).
3-8 Sodium Hypochlorite	Porsidehyde	3-A Steam-Water  3-A Tetrachloroethane, Sym.	3-A Stearic Acid	3-A Sulphur Manachlorida	3-A (Use "A" cement with threaded joints for conc. above 23 %)
3-8 Sodium Hypochlorite	Porsidehyde	Phosphoric Acid  3-A  Steam-Water	3-A Stearic Acid	3-A Sulphur Manachlorida	3-A (Use "A" cement with threaded joints for conc. chopse 27 %).
3-8 Sodium Hypochlorite	Porsidehyde	3-A Steam-Water  3-A Tetrachloroethane, Sym.	3-A Stearic Acid	3-A Sulphur Manachloride  3-B Trichloreethylene	3-A (Use "A" cement with threaded joints for conc. chopse 27 %).
3-8 Sodium Hypochlorite	Porsidehyde	3-A Steam-Water  3-A Tetrachloroethane, Sym.	3-A Stearic Acid	3-A Sulphur Manachlorida	3-A (Use "A" cement with threaded joints for conc. chopse 27 %).
3-8 Sodium Hypochlorite	Porsidehyde	3-A Steam-Water  3-A Tetrachloroethane, Sym.	3-A Stearic Acid	3-A Sulphur Manachlorida  3-B Trichloraethylana	3-A (Use "A" cement with threaded joints for conc. chopse 27 %).
3-8 Sodium Hypochlorite	Porsidehyde	3-A Steam-Water  3-A Tetrachloroethane, Sym.	3-A Stearic Acid	3-A Sulphur Manachloride  3-B Trichloroethylano	3-A (Use "A" cement with threaded joints for conc. above 23 %)
3-8 Sodium Hypochlorite	Porsidehyde	3-A Steam-Water  3-A Tetrachloroethane, Sym.	3-A Stearic Acid	3-A Sulphur Manachlorida  3-B Trichloraethylana	3-A (Use "A" cement with threaded joints for conc. oboyer 37 %)
3-8 Sodium Hypochlorite	Porsidehyde	3-A Steam-Water  3-A Tetrachloroethane, Sym.	3-A Stearic Acid	3-A Sulphur Manachloride  3-B Trichloroethylano	3-A (Use "A" cement with threaded joints for conc. oboyer 37 %)
3-8 Sodium Hypochlorite  A A Sulphuraus Acid*	Porsidehyde	3-A Steam-Water  3-A Tetrachloroethane, Sym.	3-A Stearic Acid	3-A Sulphur Manachlorida  3-B Trichloruethylana	48



will find in the Mahon organization a unique source with complete, modern fabricating, machining and handling equipment to cope with any type of work regardless of size or weight . . . a source where skillful designing and advanced fabricating technique are supplemented by craftsmanship which assures you a smoother, finer appearing job, embodying every advantage of Steel-Weld Fabrication.

MAHON COMPANY DETROIT 34, MICHIGAN

Engineers and Fabricators of Steel in Any Form for Any Purpose

## A Colmonoy Sprayweld Process application

Maintenance men working on agitators (used in the fermentation processing of an important drug) were highly pleased with this solution to their fast wearing stub shafts.

Problem: These 18 inch, 20 pound stub shafts are made of a high nickel corrosionresistant alloy. The wear encountered is primarily abrasion, but as these shafts are used in mixing material containing both

# Stub shaft hard-faced with the SPRAYWELDER\* Lasts 17 Times Longer

sulphuric and phosphoric acids, corrosion is also present. They had the disappointing service life of only three weeks.

Solution: Worn stub shafts are now overlaid with powdered COLMONOY No. 6 hard-facing alloy, using the COLMONOY Spraywelder\*. Only 1 lb. of alloy is required to weld a wear-resistant hard-facing .020" thick, on each shaft. These reclaimed stub shafts last over a full year—over seventeen times as long as did new shafts.

While this long uninterrupted service is the prime advantage of their using COL-MONOY, the greatly lowered replacement cost is also impressive.

Remember that COLMONOY stands for a complete line of hard-facing alloys. Various alloys designed to meet every type of wear are available in many forms: rod, paste, powder, wire, and castings.

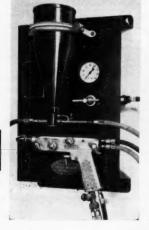
\*THE SPRAYWELDER is a metal spraying unit made for applying Colmency powdered alloys. A smooth uniform everlay is atteined by spraying. This overlay is then fused to the base metal with an axy-acetylene flame. Only a minimum of grindling is required because of the close control (within .010") of the overlay thickness during spraying. The Spraywelder consists of the pistol, hoses, hopper, and air filter and regulator, all on a sturdy panel.

Write for more information about Colmonoy alloys and the Spraywelder.

Branches: Long Island City, Buffalo, Chicago, Houston, Los Angeles, Montreal.



19545 JOHN & STREET BETROIT S, MICHIGAN



Corrosion Forum, cont. . .

Carbon & Graphite (key on p. 280)



	Zinc Sulph	nate
-		
	3-A	

#### Using Sorbitol? Store in Stainless

Certain industries that use large volumes of sorbitol and, therefore, do not store it for long periods, are using iron piping and iron storage tanks with very satisfactory results. However, iron piping and tanks are not recommended for general use. Sorbitol, like any of the polvols will eventually "scour" the inside of an iron tank, and while it will not appreciably corrode the tank or piping, it may absorb iron oxide and discolor slightly. In products where the purity and clear color of the sorbitol are important, provision should be made to prevent this scouring action.

To deliver an absolutely standard product meeting the strict purity specifications of customers in the food industry, the manufacturers use stainless steel storage tanks. Even the tank cars in which sorbitol is shipped are of stainless steel or aluminum, neither of which are affected by sorbitol. The choice of material for your system should be dictated by the length of storage, degree of purity required and the usual economic considerations.

Any of the following materials may be used and will prove satisfactory. In order of preference, these materials are: stainless steel, aluminum, tanks coated with a protective resin coating, tanks protected by a suitable lining of tin, glass, rubber.

For reasons of economy and availability, there is much interest in the use of protective resin coatings. They are economical, do a good job and show excellent promise of long life and use. Those with which Atlas has had experience are the high-baked phenols such as Heresite P-403 (Heresite & Chemical Co.), Interchemical Co. 4A (Interchemical Corp.), and Unichrome B 124-1 (United Chromium Inc.).

(Continued)



# YOU get EXPERT ASSISTANCE with Esso Solvents

FOR TECHNICAL ASSISTANCE—If you have a solvents problem, want further information on the specifications and characteristics of Esso Solvents, or need assistance with the use of solvents in your industry—write or call our office nearest you. Our well qualified technicians will be glad to assist you.

#### YOU CAN DEPEND ON ESSO SOLVENTS FOR

 MODERN HANDLING METHODS — separate tank storage, pumping lines, tank cars and trucks, are used in all Esso Solvent handling operations. Prompt, efficient delivery to your doorstep is assured.

- MULTI-STORAGE AVAILABILITY—Water terminals in many industrial centers.
- UNIFORMITY made in modern refineries from carefully selected crude oil sources.
- ECONOMY—closely controlled quality gives constant, efficient industrial processing, high-quality products.
- controlled evaporation available in a wide range of evaporation rates with precise characteristics to meet your requirements.
- SOLVENCY Esso aliphatics and Solvesso aromatics cover both high and low solvency ranges.
- VERSATILITY—dependable quality for a wide range of uses.



Controlled high quality helps produce larger profits with versatile, dependable Esso Solvents.

PETROLEUM SOLVENTS

SOLD IN Me., N. H., Vt., Mass., R. I., Conn., N. Y., N. J., Pa., Del., Md., D. C., Va., W. Va., N. C., S. C., Tenn., Ark., La.

ESSO STANDARD OIL COMPANY — Boston, Mass. — New York, N. Y. — Elizabeth, N. J. — Philadelphia, Pa.—Baltimore, Md.—Richmond, Va.—Charleston, West Va.—Charlotte, N. C.—Columbia, S. C.—Memphis, Tenn.—New Orleans, La.



America's foremost chemical plants use 'Surface' industrial gas burners by the thousands, for making petrochemicals, synthesis gas, pharmaceuticals, pulp and paper... their applications are endless.

Surface Combustion industrial gas burners are selected for:

- Flexibility—wide range of turn-down.
- 2 Operating efficiency.
- 3 High or low pressure—fuels at all pressures can be used.
- Versatility—efficient with a wide range of gases including manufactured gas, natural gas, propane and butane.
- Constant flame control—essential inchemical plant processes.

Selection of these burners is another instance of Surface Combustion's acceptance by the chemical process industry. With 70 types of gas burners in 700 sizes, 'Surface' can meet your burner requirements.

# Subface Combustion

orporation

Surface Kathabar Janitral

Send me																			r	6		H
for					*							,					*					
	 *										×					*			*			
Name								•			*		*									
Position.	 		*	*			*			*		*	*			*		,				
Company	 * 1	 *			*				*													
Address.	 	*	*										*									
City	 					z	e		10	٠.				5	1	a	81					

Corrosion Forum, cont. . .

## **Corrosion Inhibitor Checklist**

Are you wondering what inhibitor to use to help solve your corrosion problem? This checklist may save you the time required for making a survey of the literature.

MAXEY BROOKE
Phillips Oil Co., Sweeny Refinery, Sweeny, Tex.

A chemical engineer frequently finds himself processing a liquid in a vessel not designed to handle it. Economics dictate that he cannot change it and he can't stand the corrosion. Faced with this situation he has two alternatives: (a) he can live with it, or (b) he can add an inhibitor.

Next comes the step of pouring through handbooks and journals to find the appropriate inhibitor. This done, he can sit back and hope his choice is good. All of this takes time. While our engineer is checking his regular work is piling up on him. To get out of his strain, he frequently wishes that he had an inhibitor check list. So here it is. It makes no pretention to being complete but it does cover representative liquids and metals, as indicated in the references. Since the author has had no experience with most of the inhibitors listed, the list is not to be taken as an indication of the effectiveness of the individual inhibitors.

Metal	Environment	Inhibitor R	eference
Admiralty	Ammonia, 5%	0.5% hydrofluoric acid 0.003 M α phenylacridine, β naphthoquinone	27
		acridine, thiourea or 2-phenylquinoline	18
Aluminum	Acid nitric, 2-5%	0.05% hexamethylene tetramine	11
Aluminum	Acid nitric, 10%	0.1% hexamethylene tetramine	11
Aluminum	Acid nitric, 2-5% Acid nitric, 10% Acid nitric, 10% Acid nitric, 20%	0.1% alkali chromate	9
Aluminum	Acid nitric, 20%	0.5% hexamethylene tetramine	11 26
Aluminum	Acid phosphoric.	Alkali chromates.	0 20
Aluminum	Acid phosphoric, 20-80%	1.00% sodium chromate	9, 32
Aluminum	Acid sulphuric, conc	1.0% sodium chromate	22
Aluminum	Alcohol anti-freese	Sodium nitrite & sodium molybdate	2
Aluminum	Bromine water	Sodium silicate	6
Aluminum	Bromoform	Amines	21
Aluminum	Carbon tetrachloride	0.05% formamide	28
Aluminum	Chlorine water	Sodium silicate	6
Aluminum	Calcium chloride, sat	Alkali silicates	31
Aluminum	Ethanol, bot Ethanol, commercial	Potassium dichromate 0.03% alkali carbonates, lactates, acetates or	26
Munumum	Estuanos, commercial	borates	24
Aluminum	Ethylene givcol	Sodium tungstate or sodium molybdate	19
Aluminum	Ethylene glycol	Alkali borates & phosphates	26
Aluminum	Ethylene glycol	0.01-1.0% sodium nitrate	3
Aluminum	Hydrogen peroxide	Sodium metasilicate	31
Aluminum	Mathul alashal		20
Aluminum	Methyl chloride	Water	38
Aluminum	Sodium hydroxide, 1%	Alkali silicates	31
Aluminum	Methyl chloride. Sodium hydroxide, 1%. Sodium hydroxide, 1%. Sodium hydroxide, 4%.	3-4% potassium permanganate	10
Aluminum	Rodium contate	18% glucose	30
Aluminum	Sodium chloride 3 50%	1% sodium chromate	11
Aluminum	Sodium chloride, 3.5%	0.2% andium silicate	13
Aluminum	Sodium carbonate, 10%	0.2% sodium silicate	13
Aluminum	Sodium suiphide	Sulphur	23
Aluminum	Sodium sulphide	1% sodium metasilicate. 1% sodium nitrate or 0.3% sodium chromate 1% sodium metasilicate	31
Aluminum	Tetrahydrofurfuryl alcohol	1% sodium nitrate or 0.3% sodium chromate	8
Aluminum	Triethanolamine	1% sodium metasilicate	11
Copper & brass.	Acid sulphuric, dil	Benzyl thiocyanate	35
Copper & brass.	Ethylene glycol	Alkali borates & phosphates	11
Copper & brass.	r biyndric alconol anti-freeze.	0.4-1.6% Nas PO <sub>4</sub> plus 0.3-0.6% sodium silicate plus 0.2-0.6% sodium mercaptobensothiasole	
		0.3-0.6% sodium mercantohensothiasole	33
Copper & brass.	Rapeseed oil	Succinic acid	5
Copper & brass.	Sulphur in benzene solution	0.2% 9, 10 anthraquinone	14
Copper & brass.	Tetrahydrofurfuryl alcohol	1% sodium nitrate or 0.3% sodium chromate	8
Copper & brass.	Water-alcohol	0.25% hengoic acid or 0.25% andium hen-	
Managarian	42-4-3	roate at a pH of 7.5-10.	12
Magnesium	Alcohol	Alkaline metal sulphides	9
Magnesium	Glycerine	Alkaline metal sulphides	9
Magnesium	Trichlorethylene	0.05% formamide	28
Magnesium	Water	1% potassium dichromate	4
Monel	Sodium chloride, 0.1% Tap water	0.1% sodium nitrite. 0.1% sodium nitrite.	38
Monel	Tap water	0.1% sodium nitrite	38
Stainless steel	Acid sulphuric, 2.5%	5-20 ppm, Ca8O4.5H <sub>2</sub> O	15
Stainless steel	Cyanamide	50-500 ppm. ammonium phosphate	34
Steel	Acid citric	Cadmium salta	16
Steel	Acid sulphuric, dil	Aromatic amines	25
Steel	Acid sulphuric, 80%	Arsenic	40
Steel	Ethylene glycol	Alkali borates & phosphates	11
Steel	Ethylene glycol	Guanidine or guanidine carbonate	86
Steel	Ethylene glycol Ethyl alcohol, 70%	0.15% ammonium carbonate plus 1% am-	
0. 1		monium hydroxide	29
Steel	Isopropanol, 30%	0.03% sodium nitrite plus 0.015% oleic acid 0.2% sodium nitrite	38
Steel	Sodium chloride, 0.05%	0.2% sodium nitrite	38
Steel	Sulphide containing brine Tetrahydrofurfuryl alcohol	Formaldenyde	7
	renesyuroruriury; asconol	1% sodium nitrate or 0.3% sodium chromate	8

Steel Steel	Water for flooding operations	Benzoic acid Rosin amine Sodium nitrite	37 17 39
Tin plate	Carbon tetrachloride Sodium chloride, 0.05%	2% mesityl oxide, 0.001% diphenylamine 0.2% sodium nitrite	41
References			
	S., U.S.P. 2,513,131 (June	97 1050)	
2. Bayes, A.	L., U.S.P. 2,147,395 (Feb.	14, 1939).	
3. Bayes, A.	L., U.S.P. 2,153,952 (Apr.	11, 1939).	
5. Bhatnagar	t Dibelka, H., U.S.P. 1,876, r, S. S. & Krishnamurth,	K. G., J. Sci. Ind. Res. (India) 4,	238

(1945), C.A. 40, 28-6. W. v. Erftwerk, A. G., Aluminium, 3, 347-8 (1931). Clay, J. A. Jr., Pet. Engr., 18, No. 2, 111-14 (1946). Clendenning, K. A., Can, J. Research, 26 F., 209-20 (1948). Cledenning, K. A., Can, J. Research, 26 F., 209-20 (1948). Cledenning, K. A., Can, J. Research, 26 F., 209-20 (1948). Cledenning, K. A., Can, J. Research, 26 F., 209-20 (1948). Cledenning, K. A., Can, J. Research, 26 F., 209-20 (1948). Cledenning, K. A., Can, J. Research, 26 F., 209-20 (1948). Cledenning, K. A., Can, J. Research, 26 F., 209-20 (1948). Cledenning, K. A., Can, J. Research, 27 (1949). Cledenning, K. A., Can, J. Research, 27 (1949). Elder, J. A. Jr., U.S. Pats, 2,487, 755-6 (Aug., 9, 1949). Cleden, J. A. Jr., U.S. Pats, 2,487, 755-6 (Aug., 9, 1949). Cleden, J. Research, 27 (1949). Cledenning, K. R. A., Can, J. Research, 27 (1949). Cledenning, M. C., U.S.P., 2,462,538 (Feb. 22, 1949). Cledenning, M. C.

Gindin & Sir Dokhady Akude. Nauk SSSR, 63. No. 6, 685-8 (1948), C.A. 43, 4207 c. Hetherington, H. C., U.S.P. 2, 42, 238 (Feb. 22, 1949). Hoar, T. P. & Havenhand, D. J., Iron Steel Inst. (London) 133, 252 (1936). Howell, W. E. Barton, J. K. & Heck, E. T., Producers Monthly, 13, No. 7, 27-34 (1949). Jenckel & Woltmann, Z. anorg. allgem. Chem., 217, 298 (1934). Lamprey, H., U.S.P. 2,153,961 (Apr. 11, 1939). Lichtenberg, H., Aluminium, 19, 504-9 (1937). Lichtenberg, H., Aluminium, 20, 264-5 (1937). Lichtenberg, H., Aluminium, 20, 264-5 (1938). Lichtenberg, H., Aluminium, 20, 264-5 (1938). Lichtenberg, H., Aluminium, 20, 784 (1938). McDermatt, P. A., U.S.P. 1, 127,7842 (Sept. 26, 1933). McDermatt, P. A., U.S.P. 1, 127,7842 (Sept. 26, 1933). Mann, C. A., Lauer, B. E. & Hultin, C. T., Ind. Eng. Chem., 28, 1048-51 (1936). Mann, C. A., Lauer, B. E. & Hultin, C. T., Ind. Eng. Chem., 28, 403 (1943). Phillips, C. Jr., U.S.P. 2,550,425 (Apr. 24, 1951). Phieddemann, E. P. & Rathmann, R., U.S.P. 2,423,343 (July 1, 1947). Rae, Mfg. Chem., 18, 394 (1945). Rhodes, F. H. & Berner, F. W., Ind. Eng. Chem., 25, 1336-7 (1933). Rohrig, H., Aluminium 17, 559-82 (1935). Rohrig, H. & Gaier, K., Aluminium, 19, 448-50 (1937). Smith, W. R., U.S.P. 2,524,484 (Oct. 3, 1950). Swain, R. C. & Paden, J. H., U.S.P. 2,518,590 (June 20, 1950). Unlig, H. H., Corrosion Handbook, ist. Ed., John Wiley & Sons. Unknown Light Metals, 12, No. 134, 165-8 (1949), see Corrosion 6, 42 (1950). Vernor, W. H. J., Corrosion Handbook, ist. Ed., John Wiley & Sons. Unknown Light Metals, 12, No. 134, 165-8 (1949), see Corrosion 6, 42 (1950). Wachter, A. & Smith, S. S., Ind. Eng. Chem., 35, 358-67 (1942). Wachter, A. & Smith, S. S., Ind. Eng. Chem., 35, 358-67 (1942). Wachter, A. & Smith, S. S., Ind. Eng. Chem., 36, 366 (1947). Williams, U. S. Signal Laboratory, Fort Monmouth, N. J., Technical Memorandum No. M-1156 (1948).

#### First Comprehensive Guide to **Good Painting Practice**

About to be released are the first set of tentative specifications to be issued by the newly-formed Steel Structures Painting Council. The first set will cover the various methods of surface preparation.

These specs, when completed and supplemented with a "manual of recognized good practice," are expected to develop into the first really comprehensive guide for those interested in the protection of structural steel against the ravages of corrosion through the use of protective coatings.

Surface preparation, coating formulation, chemical pretreatments, prewetting, and application procedures for the various painting systems represent some of the ground to be covered in this project.

While the specs covering these phases of the protection problem will be universally applicable, their use as they pertain to specific industries such as the chemical industry will be interpreted in the "manual of recognized good practice." One complete chapter will be devoted to the painting of chemical plants.

The tentative specs will undergo a

period of test of a year or so before becoming permanent. During this time suggestions from users as to changes will be reviewed.

Significance—Development of these painting specifications gives industry sorely-needed set of standards. When a job is to be done, the specs used in conjunction with the manual will first of all point quickly to the best known way of doing the job; then they will tell how to do it.

Instead of laboriously detailing the job on the basis of information that may not be the best available, users of the specs, such as maintenance superintendents and design engineers, will be able to stipulate this or that spec with any modifications that seem advisable for a given situation.

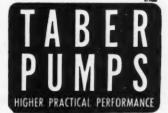
Who's Behind It—This project is supported by the Steel Structures Painting Council. The council was organized May 9, 1950 at the Mellon Institute of Industrial Research in Pittsburgh. It is composed of the representatives of a number of associations and organizations concerned with manufacture, specification or use of paints and other coatings for the protection of steel surfaces.

At the organization meeting a temporary executive committee was elected



boxes in Bulletin S-147 is designed to suggest solution of common stuffing box difficulties in individual pumping operations. • It offers suggestions on such vital matters as number of rings to use, depth of box, and type of packing. . It points out that chemical and physical properties of the liquid, speed of shaft, pressure, and temperatures are governing factors; that reciprocating piston rods are easier to pack than rotating shafts; that extra-deep boxes are not always the most effective; and that new rings should not be added to packing that has lost its resilience. . Much other valuable information is included. • Please use business stationery when writing for this SERVICE BULLETIN S-147.

TABER PUMP CO. (Est. 1859) 294 Elm St., Buffalo 3, N. Y.



# MPORTANT USE for PLA-TANK<sup>®</sup> This is probably one of the most significant applications yet for this new corrosion-

**Resin-Bonded Fiberglas Material** 



#### **Chemical and Laboratory Waste Treatment Tanks** and Corrosion-Resistant Drain-Pipe

The 500-gal. tank shown here is part of such a system, holding corrosive liquid waste and aerating it during treatment before discharge.

PLA-TANK material is ideal for such uses. It is strong, yet light weight. Its thin wall section is molded into almost any shape. Connections may be integrally formed at any point. The chemical resistance of its polyester resin and Fiberglas is ideal for most waste disposal products. Deliveries are good, cost is competitive with or lower than other suitable materials.

In electro-plating shops or chemical plants where drain-pipe corrosion is a problem, PLA-TANK pipe from 2"-48" can help you.

Before you order any corrosionresistant material for TANKS, DRAIN-PIPE. FUME DUCT or VENT HOODS, send us a sketch for free quotation and recommendations using PLA-TANK.

The Chemical Corporation

resistant material!

I suggest YOU look into

PLA-TANK

for corrosive

waste systems.

B.H. Gardner



Corrosion Forum, cont. .

comprising J. E. Jackson, representing the American Institute of Steel Construction, chairman; G. G. Sward, representing the National Paint, Varnish and Lacquer Ass'n; V. V. Kendall, representing the National Ass'n. of Corrosion Engineers; and G. M. Magee, representing the American Railway Engineering Ass'n. Since then, C. E. Webb and J. O. Jackson of the American Institute of Steel Construction have been added to the executive committee.

The research and publication committee consists of J. O. Jackson, chairman, representing the American Institute of Steel Construction; M. A. Roose, representing the American Railway Engineering Ass'n; A. J. Eickhoff, representing the American Society for Testing Materials; A. J. Liebman, representing the National Ass'n. of Corrosion Engineers; and N. W. Morgan, representing the U.S. Bureau of Public Roads.

A research fellowship has been established at the Mellon Institute for the purpose of assisting in the work of the council. Dr. Joseph Bigos. Senior Fellow at Mellon Institute, is the director of research for the Steel Structures Painting Council.

#### More About Applications of **New Chrome Carbides**

Mechanical parts for all types of machinery that must resist wear, corrosion, high temperatures or erosion are naturals for grade 608 chrome carbide, first of a new series of cemented chrome carbides to be made available by the Carboloy Dept. of General Electric Co. Some applications for this material may overlap those for tungsten carbide, but the properties exceed tungsten carbide in so many specific factors that this will undoubtedly prove to be the exception rather than the rule.

In the chemical field, its resistance to acids and sodium hydroxide indicates that nozzle and control valve components are ideal applications.

In the pharmaceutical and food processing fields, the material will also find applications in valves and nozzles because of its resistance to citric and lactic acids. Scraper blades for centrifuges and seal rings for homogenizing equipment are other excellent chrome carbide applications.

The petroleum industry in which



### **ENDURO STAINLESS STEEL**

### Makes Continuous "Photo Silver" Process Practical

• Near-perfect purity is essential for silver nitrate crystals, chief ingredient of photographic emulsions. Neither contamination products, nor contamination from process equipment, can be tolerated.

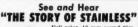
That's why, in Eastman Kodak Company's relatively new continuous process for manufacturing "photo silver," all product-contacting surfaces are ENDURO Stainless Steel. The 75-pound silver ingots-99.97% pure-are dissolved with nitric acid in ENDURO containers. Crystals are formed and grown in 1000-gallon ENDURO tanks, spun in ENDURO baskets and dried in ENDURO dryers.

Here, ENDURO resists the action of silver-dissolving nitric acid. It faithfully protects the purity of the silver salts. ENDURO does not contaminate metallically. It resists rust and corrosion, is remarkably easy to clean and to keep clean, discourages the accumulation of possible contaminants.

Have you a special problem-in process or product? Republic-world's largest producer of alloy and stainless steels-offers you the confidential services of technical and metallurgical staffs. Your letter will bring prompt and competent assistance on any development work involving the use of stainless steels. Just write:

### REPUBLIC STEEL CORPORATION

Alloy Steel Division . Massillon, Ohio CLEVELAND 1, OHIO GENERAL OFFICES Export Department: Chrysler Building, New York 17, N.Y.





teresting. Available to qualified groups without charge
Requires 16 mm sound projector. Send name of organ
isation, type of projector, requested date to Ideal Picture
5 E.So. Water St., Chicago, I, Ill., or with
6 Steel, Dept. K. Cleveland 1, Obio



Other Republic Products include Carbon and Alloy Steels — Pipe, Sheets, Bolts and Nuts, Tin Plate, Tubing, Niles Barrels and Drums



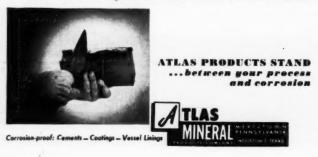
ATLAS corrosion-proof cement and brick constructions are not mere substitutes. They possess superior qualities for many applications . . . and enable you to cut construction costs in handling many corrosive chemicals.

### ATLAS ALKOR 5E . . . nearest approach to a universal corrosion-proof cement

ALKOR 5E provides a particular combination of resistance characteristics that broaden the use of acid-proof brick construction throughout industry. In addition to resistance to all non-oxidizing acids, alkalies and solvents, it also resists fats, oils and greases; and may be used for temperatures up to 380°F,

Just released . . . NEW BULLETIN 5-2 will be sent to you upon request.

RECOMMENDATIONS for your specific requirements may be obtained without obligation from the ATLAS Technical Service.



Corrosion Forum, cont. . .

valve components must resist abrasive fluids and corrosive liquids containing salts can make good use of chrome carbide parts.

Because chrome carbide has about the same thermal expansion rate as steel it is finding wide application in the gage manufacturing field where wear resistance of gaging surfaces and temperature effects of expansion are important considerations. The corrosion resistance of the chrome carbide gaging surfaces is also a factor in prolonging gage surface life.

Completely non-magnetic properties mean that it is possible to make instrument components that are non-magnetic and yet highly resistant to wear and corrosion.

The new metal is composed of 83 percent chrome carbide, 2 percent tungsten carbide and 15 percent nickel. Among its outstanding physical properties are its density, which is about half that of tungsten carbide, and its coefficient of thermal expansion, which approximates that of steel. Actually tungsten carbide has a thermal expansion coefficient about half that of steel. The new chrome carbide is a hard, strong metal that resists abrasion much better than hardened steel.

When subjected to sulphuric acid corrosion tests, Series 600 chrome carbides show 30 times the resistance of 18-8 stainless steels and 3 times the resistance of conventional carbides. Resistance of chrome carbides to nitric acid is 8 times that of other carbides and twice that of 18-8 stainless steel. Chrome carbides are inert when exposed to such acids as citric and lactic acids.

They resist oxidation at all temperatures up to 1,832 deg. F. When subjected to a temperature of 1,850 deg. F. for 24 hr. samples of chrome carbide are only slightly discolored, while simultaneously exposed samples of stainless steel and tungsten carbide have reached a state of complete disintegration.

Steam erosion tests show a resistance for chrome carbides about 50 times that of conventional carbides. Samples 1½ in. in dia. and 0.250 in. thick were placed ½ in. in front of a 350 psi. jet of saturated steam passing through a ¼ in. dia. nozzle for 25 hr. periods.

Four tests of 25 hr. each made with different but identical nozzle assem-

### What one analysis gives you maximum tube life per dollar? Ask the experts!

This month's report is on:

SICROMO 3

Has high degree of surface stability under oxidizing conditions up to 1200°F. Excellent oxidation resistance and good corrosion resistance. For use in cracking furnaces, heat exchangers, hot oil lines, superheaters, and for forgings and other parts exposed to oxidation or oil corrosion.

Carbon-Mo. DM-2 Silmo	Sicromo 2½ 2½% Cr1% Mo. Sicromo 3 4-6% CrMo.	Sicromo 5MS Sicromo 7 Sicromo 9M 18-8 Stainless	25-20 25-12 35-15* 16-25-6*
-----------------------------	---	--	--------------------------------------

The Timken Company's metallurgists are recognized authorities on high temperature steels. Backed by more than 20 years research and with 23 different analyses to choose from, they'll help you select the one steel that will give you the best life/cost ratio. And no matter which analysis you select, you can be sure of uniform quality, because the Timken Com-

corrosion and oxidation conditions.

NE and only one analysis of high temperature

per dollar under a particular set of heat, pressure,

steel tubing can give you maximum tube life

pany controls quality from melt shop through final inspection.

Let our "RSQ"-Research, Supply, Quality-solve your tube problems. Ask the experts! The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable address: "TIMROSCO".



Timken high temperature tubing must pass many rigid inspections. Pictured above is the cooling bed where powerful lights permit careful inspection of the inside surface of Timken high temperature tubing.

YEARS AHEAD - THROUGH EXPERIENCE AND RESEARCH



SPECIALISTS IN FINE ALLOY STEELS, GRAPHITIC TOOL STEELS AND SEAMLESS TUBING

# Want Vinyl Coating PROTECTION? . . . Plus SIMPLE APPLICATION?

### Revolutionary Prufcoat Primer P-50 Makes it Possible to Use Vinyl Coatings Just Like Ordinary Paints

If you want the superior chemical resistance of vinyl base paints, yet shy away from the special application techniques such coatings formerly required, there's real news for you in Prufcoat Primer P-50.

With this amazing new inhibitive primer, you now can use vinyl coatings just like ordinary paints: (1) Prepare the surface by simple routine methods such as wire-brushing; (2) Apply heavy-bodied Prufcoat Primer P-50 by brush or spray, just as you would red lead; (3) Then make your vinyl top coat application in a matter of hours.

On old or new metal, this quick, easy "Prime and Paint" procedure eliminates all danger of underfilm failures as well as providing positive primer-to-surface and vinyl-to-primer adhesion. It's a revolutionary, simpler vinyl system that licks the toughest corrosion problems, while slashing hours off labor time . . . dollars off painting costs.

But that's only part of the story. Prufcoat Primer P-50 fills the same need for controlling underfilm corrosion and assuring positive top coat adhesion, whether a heavy-duty vinyl coating or a conventional paint finish is to be applied . . . a unique "one-primer-for-all-finishes" advantage that means important additional savings.

Yes, Prufcoat Primer P-50 can save time, trouble and money ... throughout your plant ... as well as in your most difficult corrosion areas. For the full story, send for Prufcoat Technical Bulletin No. 015. Or better still, get a trial quantity of Primer P-50 along with some "A" Series Prufcoat vinyl coating and see for yourself under your own plant conditions. Act today!



#### MAINTENANCE ENGINEERS!

### Check These Primer P-50 Features

- V The first completely practi-
- V Only routine surface preparation is needed.
- V Applies like ordinary paint and dries fast.
- V Positive adhesion to old or new metal is assured.
- V Under-film corrosion and rust creepage are controlled.

### PRUFCOAT LABORATORIES, INC. 50 East 42nd Street, New York 17, N. Y.

To Save Time, Trouble and Money
Just "PRIME and PAINT" with PRUFCOAT

CORROSION FORUM, cont. . .

blies show no measurable erosion penetration on the chrome carbide samples after the first three tests. Maximum average penetration after the first 100 hr. is 0.0004 in. These tests show that chrome carbides are equivalent to other metals with the maximum amount of resistance to steam erosion.

### New High-Strength Aluminum

Dr. Henry H. Hausner, manager of atomic energy engineering, Sylvania Electric Products Inc., reports results of work in Switzerland that has produced a new type of sintered aluminum.

Aluminum strength is dependent on grain size, and grain size can be controlled more closely by powder metallury than by any other metallurgical technique. Due to its very fine grain structure, sintered aluminum exhibits a greatly superior fatigue strength at high temperatures, as compared with the conventionally-formed metal.

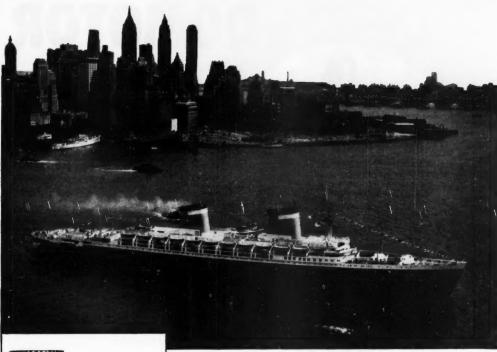
### **NACE 1953 National Meeting**

Topics for five of the symposia to be given at the March 16-20, 1953 conference and exhibition of the National Association of Corrosion Engineers at Chicago have been selected. H. W. Schmidt, technical program chairman, also named some of the officials for these symposia.

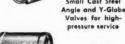
The five-day meeting at Chicago is expected to attract more than 1,500 registrants. NACE now has more than 3,600 members in 47 states and more than 40 foreign countries throughout the world.

Symposia and officials named by Mr. Schmidt are: cathodic protection, E. P. Doremus, Cathodic Protection Service, Houston, chairman; high temperature corrosion, John Rutherford, Babcock and Wilcox Tube Co., Beaver Falls, Pa., chairman; protective coatings, L. L. Whiteneck, Long Beach Harbor Dept., Long Beach, Cal., chairman and N. K. Senatoroff, Southern Counties Gas Co. of California, Los Angeles, co-chairman; oil and gas production industry, H. L. Bilhartz, Atlantic Refining Co., Dallas, chairman; chemical industry, C. A. Coberly, Mallinckrodt Chemical Co., St. Louis.

-End









Walseal Bronze Strainer



Walseal Bronze Globe Valve

Walseal



Walseal Branze Union End Tee

### Walworth is proud to be aboard the S. S. United States

When the United States Lines, the Newport News Shipbuilding & Dry Dock Company, and Gibbs & Cox, Inc., naval architects, join forces to build the fastest, safest and most modern liner the world has ever seen, the selected materials and components have to be top quality. Walworth Pressure-Seal Cast Steel Gate, Globe, and Angle Valves, and Walworth Small Cast Steel Angle and Y-Globe Valves for high-pressure service are installed in the main steam lines of the S. S. United States. Brass and copper lines use large numbers of Walseal valves, fittings, strainers, and unions.

Knowing that Walworth valves and fittings are a vital part of the power arteries aboard this great ship, the proudest moment of Walworth's 110 years of manufacturing experience came when the new Queen of the Sea broke both the east and west trans-Atlantic speed records.

As we present our compliments to Commodore Manning and his crew, to the Newport News Shipbuilding & Dry Dock Company and its men, and to William F. Gibbs and his staff, we also compliment the men and women of the Walworth Company who gave of themselves to put quality into our products and this quality ship.

### WALWORTH

valves • fittings • pipe wrenches 80 EAST 42ad STREET, NEW YORK 17, N. Y.

DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD

### DOMOTOR

the most powerful\* **NEW IDEA for** Control valves!

**DOMOTOR** operator is the key to all these advantages:

- Single Seat Construction
- .001" Positioning Accuracy
- Faster Response
- Unmatched Simplicity
- . Lighter, more compact design

### - sula

- Greater interchangeability
- Inventories reduced 50% to 75%
- In-line, lower maintenance
- Low first cost!

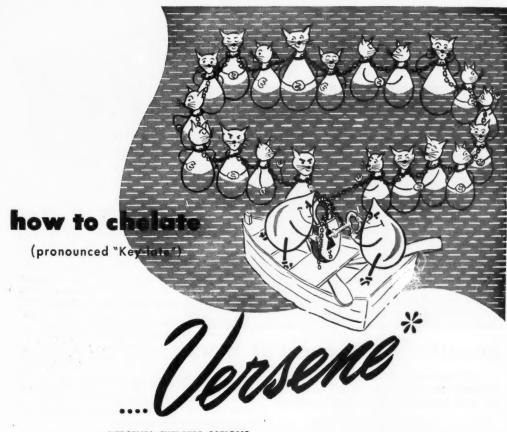
The DOMOTOR Controls Forces to 2 TONS with Hairline Accuracy-Opens new fields of application for modern instrumentation

> The Annin DOMOTOR operator offers unmatched power, stability and accuracy of valve positioning. The advantages of single seat valve construction now are made possible for applications where corrosive and erosive liquids must be accurately controlled under extremes of temperature and pressure (From-325°F to 1000°F, and to 6500 psi).

> Annin DOMOTOR Valves are noted for their superior

performance and their many cost-reducing features, but less known is the fact that they cost no more than ordinary valves-and often cost less!

Whether you want to solve a knotty instrumentation problem, reduce operating costs, or improve performance, write and give details. Annin engineers will be glad to make a recommendation. Annin General Catalog 1500B gives the full story. Write for it today.



### **VERSENE\* CHELATES CATIONS**

Before you can chelate foreign metallic ions in solutions you must have a powerful chelating agent such as Versene. This is a compound that will inactivate cations with the formation of inner ring structures in the molecule. It makes the metallic ion become part of the rings. This is a valuable thing to know because it will prevent all kinds of contamination caused by cations,

When Versene is added to a mixture of various metallic ions chelation will be preferential. That is, one metal will be complexed before another. When the first is exhausted the second will be inactivated and the process will go on until either metallic ions or Versene are used up. Page 7 of Section I of Bersworth's Technical Bulletin No. 2 gives a table which shows the order of chelation of some of the common metals at various pH's. Send for it.

### VERSENES\* - POWERFUL CHELATING AGENTS

The Versenes, made only by the Bersworth Chemical Company under processes originated, developed and patented by F. C. Bersworth, are the most powerful chelating agents known. They are exceptionally stable at high temperatures and all pH's. Quality standards of manufacture are so high that uniform complexing power is guaranteed for either sample or carload quantities. Ask for Technical Bulletin #2. Write Dept. B for samples. Chemical counsel available. available.

VERSENE® WATER TEST KIT. Tells Total Hardness in 2 minutes. Accurate to 1 grain per gal. Versenate method. Complete with instructions \$5,00 Postpaid.

\*Trade Mark Registered



### RSWORTH CHEMICAL COMPANY

FRAMINGHAM, MASSACHUSETTS

Warehouse Stocks:

George Mann — Providence, R. I.

Griffin Chemical Co. — San Francisco — Los Angeles
Siegel Chemical Co. — San Francisco — Los Angeles
Siegel Chemical Co. — Brooklyn, N. Y.

Copyright 1852 Baracourth Chambled Co.

Wasatch Chemical Co. — Salt Lake City
Kraft Chemical Co. — Salt Lake City
Kraft Chemical Co. — Chicago
C. S. Tanner Co. — Charlotte, N. C.
Copyright 1852 Baracourth Chambled Co.

CHEMICAL ENGINEERING—September 1952

295

### You and Your Job Edited by Richard V. Reeves

### Incentive Management in Theory

- Every man has latent abilities. It is up to industry to provide the
  incentives to bring out these abilities in employees so that one
  man will do the work of two, rather than two doing one's work.
- You don't have to check a player in an amateur game to see if he tries. There is no doubt he will try. Likewise, in industry under incentive management, all try. Many overhead jobs, therefore, such as many foremen, inspectors and clerks are needless, since the desire to produce at top speed and accuracy is inherent in all involved — they do not need to be watched.
- Incentive management is not a so-called efficiency scheme alone.
   It is a philosophy of life and production that develops new aspirations and usefulness in all affected by it.
- The greatest waste that can be imagined, far greater than any material waste, is the waste of man.

### Incentive Management at Work

"Incentives for engineers? It won't work!" Here is company that has made it work and whose employees are the most productive you'll find anywhere.

Almost everybody has heard of the Lincoln Electric Company of Cleveland and of its founder and chief executive, James F. Lincoln.

This organization could be called the Shangri-la of industry—the answer to the present regime of "governmentsponsored, industrial civil war, known as 'collective bargaining'" in the words of James Lincoln.

The company makes are welding equipment and are welding electrodes, but it is not for its products that the company's fame has spread. Rather, it is the concept of incentive management and the successful application of that concept that has made the name of Lincoln synonymous with good management.

This is the company that has consistently paid almost twice as much in financial compensation to its average worker as similar industries; that has had one-quarter as much labor turnover; that has not had a single manday lost by labor-management disputes in almost 20 years; that has consistently had twice the sales value of product per employee.

James Lincoln has just set forth his philosophy in a book published by his company. (Price is \$1.)

Admittedly Mr. Lincoln, like many Americans in the past, is ahead of his time. Big industry is not yet ready for profit-sharing on a large scale. And while all industry is striving conscientiously and mightily toward the goal of more human relationships between and among all levels of management and all levels of labor, the attainment is nebulous. You have one sort of relationship when one man employs 10 men and another sort of relationship when 1,000 men employ 10,000 other men.

However, if America is to survive at all, the day must come when every man—engineer, bricklayer, street cleaner—will be his own boss in the very real sense that no matter whom he works for, he will be rewarded in direct ratio to his production whether that production be material products or intangibles.

Indications that we are approaching that day, come from the successful methods of providing financial incentives for the worker in many of our major manufacturing operations.

But financial incentives for a man welding compressor mufflers are something different from incentives for the man designing them. Most companies wouldn't even think about such incentives for their engineers.

Lincoln Electric, though, has not only attempted such a system, they've made it work.

Here's how they do it:

The system is based on the philosophy that money isn't the be-all and end-all of incentive management. But, on the other hand, it's darned important. Lincoln and his associates believe that money is a driving incentive only when a man doesn't have enough of it. After he's past the breakeven point, you usually have to look for other ways to keep up his drive.

One way around this is not to increase an engineer's pay but to give him a lump-sum bonus at the end of the year. This way, a man's goal may be to buy a house or a farm or a car or a boat. The important thing is that he has a goal to strive for and the harder he strives, the closer he comes to his goal.

The amount of the bonus is based on a merit-rating system. Total bonus for all the company is determined by the success of the operation for the year. The total is then divided among the employees in direct relation to the individual worker's contribution to the total.

Each man is rated on a set of cards based on seven standards of job performance. In effect, each person is compared to others on similar jobs.

After all the ratings are made, the cards for a given department are lined up so that from the check marks an average can be determined for the group. The next step is to assign points for all ratings according to where the average falls.

This rating system allows the average for a department to "float" up or down as group performance goes up or down. This keeps the accent on continuing development, for a man could do the same job he did the previous year but get a lower bonus because the average for his department went up.



# GLAND-TYPE

**BRONZE NEEDLE VALVES** 

with fine thread-pitch for precision throttling

### **WHAT'S NEW ABOUT THEM?**

They have a new gland follower . . . they're redesigned from handwheel to seat opening . . . and yet they're competitive in price with non-gland valves.

### HOW ARE THEY FOR INSTRUMENTATION?

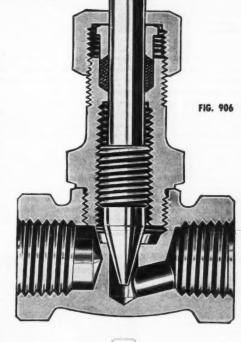
Perfect. The handwheels lend themselves to delicate fingertip control. Fig. 1565 has a special indicator handwheel with numbered graduations and a spring lock, if you prefer. They're compact, to fit behind instrument boards, and they have a very fine thread-pitch for close regulation. The seat angle is 30°. They handle 200 lbs. Steam; 400 lbs. W.O.G.

### HOW ABOUT THE STEMS?

Take your choice of "Stemalloy"\* or steel in the globe design. "Stemalloy"\* is Lunkenheimer's exclusive wear-resisting bronze alloy. Steel stems are cadmium-plated to resist rust.

### WHERE CAN YOU FIND OUT MORE?

Ask for Lunkenheimer's new Needle Valve Bulletin 568. Your distributor has it, or we'll send you a copy. Write The Lunkenheimer Company, Box 360P, Cincinnati 14, Ohio.





BRONZE . IRON . STEEL

\*Patented alloy

LUNKENHEIMER
THE ONE FREAT NAME IN VALVES

1.552-2

### BETTER BE SAFE THAN SORRY WHEN YOU'RE MOVING GAS OR AIR

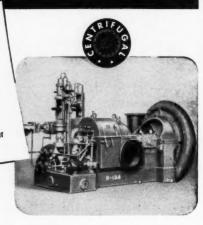
Choice of Rotary or Centrifugal Capacity matched to the job ☐ Easy accessibility

Ruggedness ☐ Ease of installation ☐ Ability to handle overloads

☐ Long-time durability Freedom from breakdowns ☐ Low maintenance costs

☐ Engineering assistance Proved reputation of maker

Customer satisfaction



Type OIB Gas Exhauster, driven steam turbine. Capacity

You can't afford to take chances when production and profits depend on maintained performance of blowers, exhausters, gas pumps or related equipment. So, we suggest that you check carefully the above factors before you make your final decision.

If you are faced with a choice between Centrifugals or Rotary Positives, remember that only Roots-Connersville makes both types. From our exclusive dual-ability line, with capacities from 10 cfm to 100,000 cfm, at moderate pressures, most buyers can find a unit closely matched to their specific needs.

We'd like to remind you, too, that for almost a century we've built only blowers and related equipment. Our products have a long, happy record for outstanding, reliable, economical performance. Our vast reservoir of engineering experience is always at your service, to meet almost every industrial problem of moving gas or air.

ROOTS-CONNERSVILLE BLOWER CORPORATION 523 Illinois Avenue, Connersville, Indiana



ONE OF THE DRESSER INDUSTRIES

YOU AND YOUR JOB, cont. . .

Last year, the total bonus divided was 104 percent of the payroll.

L. K. Stringham, Chief Engineer to the system answers the problem of setting up financial rewards for engineers in these words:

"If you accept the fact that you can set up salaries for people whose returns are intangible, and that's true of any professional man-if you accept the fact that you can set up a salary which is commensurate with the value of that man compared with the value of some man who is on piece work rates-then you have no further difficulty as far as merit rating goes.

"An interesting point in our system is that each man knows what rating he has been given. He doesn't know what other people got, but he does know what he got, and he knows the average is 100 too.

He knows that if he got 100, he did an average job. I don't say that's bad or good-he just did his job. He was adequate. If he got a higher rate than 100, that would indicate that he did more than was expected.

"We have some people dissatisfied with their ratings-and that's one reason for the system. A man may come in to complain, end up talking it over. Sometimes we find that the man is in the wrong job, or maybe something else is wrong.

"The point is that something needs correcting-and it usually is corrected."

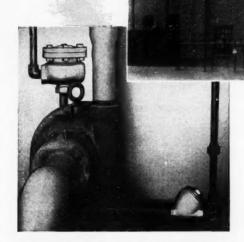
George Landis, Vice President of Engineering for the company, sums up the question of financial incentives in these words:

"One of the biggest incentives for the engineer is the feeling of doing something important, of knowing that people would miss him if he didn't come to work.

"We make our engineers responsible for their equipment from design to operation. If trouble develops in the field, the project engineer must straighten it out. That way, the engineer follows the equipment through the shop and actually sees how customers are using it.

"But we do not forget that one of the most important forms of recognition of a job well done is money. In our case, incentive management has permitted us to build a better product, at lower cost, and to pay our employees on a much higher scale in direct proportion to their contributions to the welfare of the company."

# NICHOLSON TRAPS SELECTED FOR Celanese STEAM PLANT



Above, enlarged steam generating facilities of the Celanese Corporation of America plant at Hopewell, Va., now in an extensive expansion program. Specified were Nicholson Steam Traps, two of which are shown at left.

How to use modern equipment to bring the steam generating capacity of a boilerhouse up to the needs of an extensive plant expansion program was recently demonstrated by Celanese Corporation of America at its Hopewell, Va., textile plant.

Stoker equipment to fit present space, and auxiliary equipment of the most modern nature -- all were selected with a view to attaining maximum efficiency, and desired capacity with a margin of space for further expansion. Nicholson Steam Traps were installed in connection with a new piping system which features return of the condensate and reclamation of most of its heat.

A recent survey showed these Nicholson features to be reasons why an increasing number of leading plants are standardizing on Nicholson thermostatic traps: 2 to 6 times

average drainage capacity; shorten heat-up time. Operate at lower temperature differential; fast action keeps equipment full of live steam. Maximum air-venting capacity. Types for every process, power and heat application.

### Send for CATALOG 751

A 32-page standard reference; contains installation diagrams and data for determining proper size of trap.



### W. H. NICHOLSON & CO.

TRAPS · VALVES · FLOATS

206 OREGON ST., WILKES-BARRE, PA.

Sales and Engineering Offices in 53 Principal Cities



### take a CLOSER LOOK at this



### THE BABCOCK & WILCOX COMPANY **TUBULAR PRODUCTS DIVISION**

Benver Falls, Pa. — Semiles Tubing: Welded Steinless Steel Tubing
Alliance, Ohio—Welded Carbon Steel Tubing
Sales Offices: Beaver Falls, Pa. \* Boston 16, Mass. \* Chicago 3, Ill. \*
Cleveland 14, Ohio \* Benver 1, Colo. Detroit 26, Mics. \* Chicago 1, Ill. \*
Fassa \* Ca. Angel \* De Sales Offices Steel Tubing
Fassa \* Ca. Angel \* De Sales Offices Steel Tubing
Passa \* Ca. Sales Sales



September 1952—CHEMICAL ENGINEERING

# EALTH OF TUBING DA

TECHNICAL BULLETIN



TECHNICAL DATA CARD

Tube engineering data ... prepared by engineers for engineers ... pours out of Babcock & Wilcox headquarters in an endless stream of technical literature and other communications, to keep designers, equipment manufacturers and process engineers well-informed about latest tubing developments and applications, and to provide an interchange of field experience among tube users.

Important findings of metallurgists and application engineers, of chemists and of all the other specialists concerned with pressure and temperature requirements and special tubing needs are condensed and published in ready-reference form as fast as data can be reviewed and verified.

B&W offers a most comprehensive file of information available on carbon, alloy and stainless tubing, both seamless and welded -the technical help this literature offers is exceeded only by the personal assistance on specific tubing problems you may expect from B&W field representatives.

If you want facts where you can find them -tips to help you speedily solve tubing problems and to suggest ideas for greater tubing service satisfaction-send for B&W bulletins you may select from this partial list of current data.

TECHNICAL BEPORT

### YOURS FOR

□ 18-19	B&W Stainless Croloy Tubing Steels, Seam- less and Welded, Condensed Technical Data	☐ TB-12	B&W Alloy Tubes and Pipe, Condensed Tech- nical Data on High-Temperature Steels
☐ TB-I	Properties and Methods of Working Seamless and Welded Tubes and Pipe of the B&W	☐ T8-328	How to Keep Down Maintenance Costs in Pulp and Paper Mills
	Stainless Croloys	☐ TB-329	B&W Heat Exchanger and Condenser Tubes,
☐ TB-332	B&W Stainless Pipe, Seamless or Welded		Seamless and Welded, Stainless, Alloy and
☐ TDC-130			Carbon Steels
	(Type 304), for Pressure and Mechanical Uses	☐ TB-344	Applications of B&W Tubular Products -
☐ TDC-132	B&W Stainless Pipe and Tubing, Croloy 18-8 Cb (Type 347), for Pressure and Mechanical		Stainless, Alloy and Carbon Steel, Seamless and Welded
	Uses	☐ TDC-136	Chemical Compositions, B&W Seamless
☐ TDC-133	B&W Stainless Pipe and Tubing, Croloy 16-13-3 (Type 316), for Pressure and Me-		Alloy Steel Tubing, B&W Croloy Steels of the Low and Intermediate Alloy Groups.
	chanical Uses	☐ TDC-138	B&W Pipe, Seamless and Welded, Carbon,
☐ TDC-134	B&W Stainless Pipe and Tubing, Croloy 25-20 (Type 310), for Pressure and Mechan-		Alloy and Stainless Steels, Dimensions, Weights, Specifications, Grades, Analyses
	ical Uses	☐ TA-1559	B&W Steel Tubing — Seamless or Welded
☐ TDC-140	B&W Stainless Pipe and Tubing, Croloy 12	1	Stainless, Alloy and Carbon Steels—for the Process Industries
	Al (Type 405) 18 (Type 430), 27 (Type 446), for Pressure and Mechanical Uses	☐ TB-11	Specifications for Seamless and Welded Tubular Products—Stainless, Alloy and Car-
☐ TDC-143	B&W Stainless Tubing, Croloy 12 (Type 410).		bon Steels
	12-2 (Type 414), Properties and Applications	☐ TB-15	Weight Tables, Round, Seamless and
☐ TDC-148	B&W Croloy Stainless Steels, Condensed		Welded Steel Tubing
	Data on Working Seamless or Welded Tub-	☐ TB-335	Descriptive Terms—Steel Tubing
	ing and Pipe	☐ TDC-125	Hardness Conversion Tables
☐ TA-1517	B&W Stainless Steel Tubing for the Food	☐ TR-514	How You Can Avoid Boiler Tube Corrosion
☐ TB-6	Processing Industry Properties of Carbon and Alloy Seamless	☐ TR-515	The Creep and Stress-Rupture Testing of Steam-Boiler Materials
□ 19-0	Steel Tubing for High-Temperature and High-	☐ TR-516	Some Experiences in Service, Power, Oil and
	Pressure Service	☐ 1K-310	Chemical Plants

### CLIP AND RETURN ENTIRE PAGE



Mr. Tubes — your nearby B&W Tube Representative—will be happy to pro-vide additional information and to discuss any specific tubing problem with

THE	BABO	ОСК	&	WILCOX	COMPANY
TUBU	LAR PRO	DOUCTS	DI	VISION	
	- F-II-			•	

Chemical Plants

Beaver Falls, Pennsylvania

- Please send me the B&W bulletins checked.
- Please add my name to your mailing list to receive new bulletins when available.

NAME COMPANY STREET ADDRESS\_

ZONE

### Names in the News Edited by Frances Arne



MAN OF THE MONTH: Jesse W. Mason

Georgia Tech's dean of engineering starts a year's leave to participate in E. I. du Pont de Nemours' Educator in Industry Program.

"I am looking forward with much interest to my year in industry under the DuPont program, and am certain that it will be of great benefit to me. I feel that the program as a whole, will do much to better acquaint educators with the problems which face the young graduate upon entering industry from college."

Dr. Jesse W. Mason, dean of engineering at Georgia Tech, speaking. For the next year he will be at Du Pont visiting and studying all divisions of its engineering department, discussing organization and management problems with top level management, learning about operations from middle management. He will have the opportunity to learn about the problems of the newly-employed graduate from the graduate himself. And future graduates of Georgia Tech will be the beneficiaries of this first-hand knowledge.

He will be at Du Pont through the courtesy of its recently inaugurated Engineering Educators program. Each year now Du Pont will invite several visiting educators to spend a "year-in-industry" studying the operation of the engineering department. Preference will be given to educators in accredited colleges who have administrative responsibilities or who are now actively engaged in shaping educational thinking and policies. The company pays the visiting educator his normal earnings plus expenses such as travel and moving.

Du Pont couldn't have picked a better liaison man. Dean Mason has always been an extremely popular instructor—and he's been teaching a good while. He entered the field of education in 1935 as assistant professor of chemical engineering at the University of Florida. In 1938, he came to Georgia Tech as assistant professor of chemical engineering, was made associate professor in 1940 and in 1941 became professor and head of chemical engineering. He held this position until 1948 when he was promoted to his present post.

Restless, floor-pacing Mason is impatient with paper work and is always pressing deadlines. He doesn't like to listen to speeches, does love good music.

His love for good natured practical jokes frequently infects his students. Once a fake news story, concocted by several graduate students, that he was running for dog catcher was picked up by a Boston newspaper and featured in a cartoon. A persisting consequence of this episode is that he is still harried by an occasional phone call, sometimes late at night, where all he hears at the other end of the line is the distressed yapping of a hound.

Inclined to be shy, in spite of his good humor, he once spent several days agonizing over the information (false again) that he would be expected to crown the queen of the annual engineers' ball and salute her with a kiss.

He astonishes his classes with an amazing memory, and an astounding facility for performing elaborate mathematical calculations without writing down any figures.

On account of a vague physical resemblance to the comic strip character of the same name, the nickname "Herky" has become attached to him. He also bears a striking resemblance to CE Editorial Director Sidney Kirkpatrick and has on occasion been mistaken for him.

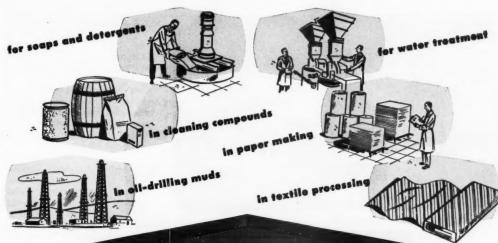
George L. Weil. To enter private consulting in nuclear reactor design and engineering, dealing particularly in problems of experimental nuclear power plants for industrial and other private organizations. Resigned as assistant director of the reactor development division of the AEC.

Raymond H. Mattson. New staff member of Jefferson Chemical Co.'s market development department. Formerly employed as a research chemist with American Cyanamid and Rohm and Haas. Doctorate in organic chemistry from the University of Illinois.

Frank A. Crossley. Associate metallurgist, Armour Research Foundation, Illinois Institute of Technology. Formerly head of the department of foundry engineering at Tennessee A. & I. University. Doctorate from Illinois Tech. New supervisor in the metals department: Verne Pulsifer, formerly chief metallurgist for Olin Industries. New assistant professor of chemistry and curator of the physical plant of the chemistry department, Illinois Tech: Van V. Alderman. New assistant professor in the department of chemistry: Arthur G. Keenan.

Jack Fedderke. Assistant to the director of contract research, Wyandotte Chemicals Corp. Formerly a staff member on Wyandotte's inorganic research team.

Ralph E. Hope. Manager of research engineering, Davison Chemical Corp., Baltimore. For the past two



### BLOCKSON Sodium Phosphates



- Sodium Tripolyphosphate
- Tetrasodium Pyrophosphate, Anhydrous
- Sodium Polyphos (Sodium Hexametaphos-
- phate) (Sodium Tetraphosphate)
   Trisodium Phosphate, Crystalline
- Chlorinated Trisodium Phosphate
- · Trisodium Phosphate, Monohydrate

- Disodium Phosphate, Anyhdrous
   Disodium Phosphate, Crystalline
   Monosodium Phosphate, Anhydrous
- Blockson Plant . . . Joliet, III.
- Monosodium Phosphate, Monohydrate
- Sodium Acid Pyrophosphate
- Sodium Silicofluoride
- Sodium Fluoride Hygrade Fertilizer





How many parts per million will kill a fish?



The treatment and disposal of industrial wastes has a lot to do with the health of fish — and people.

A plant in New Jersey had the problem of reducing pollution from 3,000 ppm in raw waste to 33 ppm in the final effluent. In planning the installation shown here, the consulting engineers called on Dorr for equipment recommendations. The resulting installation — involving equalization, predigestion, Biofiltration and slow sand filtration — is consistently providing the exact results for which it was planned.

It's a good idea to talk to Dorr about your processes involving the separation of finely divided solids in suspension, the use of ion-exchange or fluidizing techniques. The chances are that we can help you simplify your problem.

Better tools TODAY to meet tomorrow's demand

ORR

WORLD · WIDE RESEARCH · ENGINEERING · EQUIPMENT

Names in the News, cont. . .

years, Davison's representative at Warrington, England, on the design and operation of a plant built by and affiliate of Lever Bros. & Unilever Ltd for the production of petroleum cracking catalyst. Before that, plant engineer at the company's Cincinnati catalyst plant. Studied at the universities of Cincinnati and Michigan.

Philip Miller. Laboratory director, Walter Kidde nuclear laboratories. Formerly with Tennessee Valley Authority in charge of pilot plant and other process development work in inorganic chemicals. Recipient of AlChE's William H. Walker Award in 1946 for his work in the development of a process for extraction of alumina from clay.





P. Miller

G. Bachman

George S. Bachman. Director of research, Pittsburgh Plate Glass Co.'s new fiber glass division. Has been with the research laboratories of the company's glass division since 1947. Formerly a ceramic engineer with Owen-Illinois Glass Co. Doctorate from the University of Illi-

O. Harry Schrader, Jr. Vice president, United States Plywood Corp., Seattle. Has been associate professor of forest products at the University of Washington and director of the Washington State Forest Products Institute.

Thomas J. Hanratty. Assistant professor of chemical engineering, University of Illinois. Doctorate in chemical engineering from Princeton.

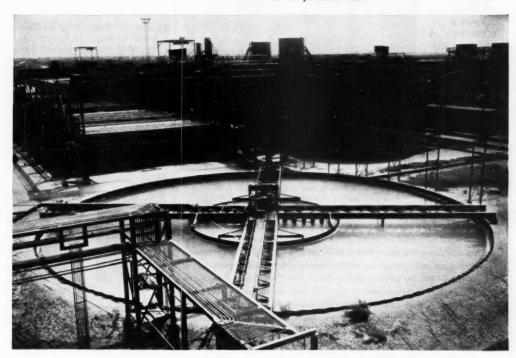
Ralph Ball. Technical director, plastics division, Celanese. With the company for 21 years mostly engaged in plastics research and development work. HERE'S HOW TO HANDLE

### **BRINE PURIFICATION**

### with a Dorrco Clariflocculator\*

Installed at a Southwestern chemical plant, this 125' dia. Dorrco Clariflocculator precipitates and removes calcium and magnesium compounds from more than 2,000 gpm of salt brine. Clariflocculator effluent goes directly to electrolytic chlorine cells.

The Clariflocculator is a natural for any brine purification job. Its design provides for flocculation and clarification in separate compartments - yet, unlike many combination units, it takes magnesium compounds in its stride. Fluctuations in feed volume and density are no problem either.



WE'LL BE GLAD TO TELL YOU MORE about the Clariflocculator or discuss the techniques of brine purification with you at your convenience. The Dorr Company, Barry Place, Stamford, Conn.



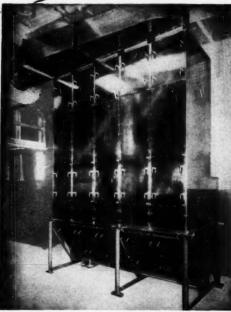
THE DORR COMPANY . ENGINEERS . STAMFORD, CONN.

Offices, Associated Companies or Representatives in principal cities of the world.

# \$ave \$ out of DU\$T

DOLLAR\$
OUT OF
DUST
in Processing of
FERTILIZERS
PLASTICS
DRUGS &
COSMETICS
FOOD MATERIALS
A OTHER
PRODUCTS

SAVE



The Simon Suction Filter Dust Collector
U. S. Design and Manufacture by
ENTOLETER DIVISION

Dust problems are effectively solved with the Simon Suction Filter Dust Collector. This self-contained, all-metal unit needs no accessory equipment except a fan and connecting ducts. Dust is collected at practically 100% efficiency, permitting air to be blown out of the chemical plant without costly loss of materials, or Into the building without risk of dusty atmosphere. Cleaned air from collector can be returned to plants to save heat in winter, and blown outside in summer to control humidity. Streamlined ALL METAL design with minimum ledges and dead spots. Minimum maintenance cost. Low power—1-HP to operate 12-section unit. Operates under suction, eliminating dust leaks. Send for complete information. ENTOLETER DIVISION, The Safety Car Heating and Lighting Co., Inc., 1197 Dixwell Ave., New Haven 4, Connecticut.

ENTOLETE DE CENTRIFUGAL MACHINES

NAMES IN THE NEWS, cont. . .

Charles C. Price. Resigned as head of Notre Dame's chemistry department. Continues as professor of chemistry.

Thomas J. Menzel. Plating chemist, Hanson-Van Winkle-Munning Co., Matawan, N. J. Formerly in charge of analytical work and customer's service work. Joined the company in 1943 as a chemist.

Karl C. Ruppenthal. Technical supervisor of Pittsburgh Coke & Chemical Co.'s newly formed fine chemicals division. Formerly a technical demonstrator and textile chemist in charge of the Philadelphia laboratory of General Dyestuff Corp. Columbia graduate.

Thomas H. Risk. Vice president, R. M. Hollingshead Corp., Camden, N. J. Formerly research engineer for the Ethyl Corp. Joined Ethyl in 1940 as acting manager of its refinery division.

George L. Brown. Vice president in charge of manufacturing, Caldwell Chemical Co., New York. Continues as head of the company's Midwest operations. With the organization since 1950.



G Brown



L. Merrill

L. K. Merrill. Vice president in charge of product and process development, Bakelite Co. Has been general superintendent of the company's vinylite plastics plant at Bound Brook, N. J., since 1945. First joined the Union Carbide and Carbon organization in 1920 when he served in the development laboratories of National Carbon, another subsidiary. Studied at Case Institute of Technology.

David Glaser, Ludwig Luft and Thomas Lentz. New members of the chemical research department, General Mills Research Laboratories.

Gordon A. Coleman. With the engineering department of the newlyformed nitrogen division, Allied Chemical and Dyc Corp., Hopewell, Va. Formerly supervisor of design and plants for the company's Barrett Division in Philadelphia.

Robert H. Krieble, Manager of engineering for the chemical materials department, General Electric's chemical division. Formerly engineer of the Thomson Laboratory of the company's Lynn River Works. Joined the GE research laboratory in Schenectady in 1943.

Edward V. Osberg. General manager to direct the overall activities, National Polychemicals, Inc., Boston. Formerly with General Tire and Rubber Co. as assistant manager of the chemical division. Prior to that, vice president of Wilmington Chemical Corp.

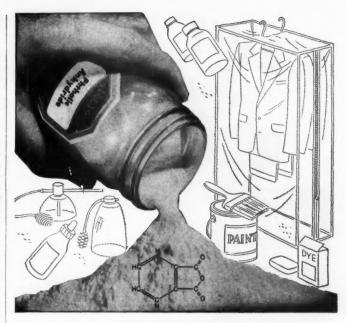
Edwin C. Jahn. Acting head of the newly created forest chemistry department, State University of New York, College of Forestry, Syracuse. Has been professor of forest chemistry and faculty member since 1938.

R. W. Lahey. Retired as manager of American Cyanamid's packaging and materials handling department. With the company since 1929. Columbia graduate.

Charles A. Strack. Head of research and testing work in the new Virgo Salt laboratory at Niagara Falls, N. Y., of Hooker Electrochemical Co.

Lester E. Johson. Product manager, Mathieson Chemical Corp.'s organic chemicals department. Formerly assistant to the manager, chemical sales development, U. S. Industrial Chemicals Co. Other previous employers: National Aniline and Chemical Division, Du Pont. Studied at the universities of South Dakota and Cincinnati.

Stewart S. Kurtz Jr. Technical associate in Sun Oil Co.'s research and development department. Since 1942, manager of the company's



# KOPPERS PHTHALIC ANHYDRIDE known for its high quality

"When water-white phthalate plasticizers are required, we prefer Koppers Phthalic Anhydride."

That's what so many of the country's best-known manufacturing concerns have told us about this quality product.

Koppers Phthalic Anhydride is a white solid in the form of small, free-flowing flakes. It has a minimum purity of 99.7%.

Its industrial importance is due primarily to the reactivity of the anhydride group with alcohols and the properties of the derivatives thus formed.

Phthalic Anhydride is used as a raw material in the manufacture of alkyd resins, in ester-type plasticizers, dyestuff intermediates, food preservatives, medicinals, pharmaceuticals, insect repellents and perfume fixatives.

A request on your letterhead will bring you complete information on Phthalic Anhydride as well as an experimental sample. Write to Koppers Company, Inc., Chemical Division, Dept. CE-9, Koppers Building, Pittsburgh 19, Pa.



### KOPPERS COMPANY, INC.

Chemical Division, Dept. CW-8-9 Koppers Building, Pittsburgh 19, Pa.



Simplex or Duplex 0-12 GPH Pressures to 300 PSI

PUMP

REPTUNE PUMP MFG. CO.
4912 North 6th Street - Philadelphia 20. Pa.

Second, the advanced design delivers efficient and

accurate performance. Third, the compact simplicity

GAS Storage Tanks

● Whether you want conventional highpressure units or something special—send us your inquiries. COLE can build you the kind of high-pressure tanks or vessels you require—any size, any shape, any metal. Our experience (of almost a century) in the design and fabrication of metal tanks may be of help to you. Write for catalog—"Tank Talk"





NAMES IN THE NEWS, cont. . .

chemical research laboratory at Norwood, Pa. His successor: C. L. Thomas.

- W. E. Blair. Executive assistant reporting to the president, Solvay Process Division. Formerly director of Solvay's product development department. With the company since 1919. Graduate of the University of Wisconsin. New director of product development: D. H. Ross, formerly assistant manager of product development. Yale graduate.
- L. R. Forrest. Staff assistant to the manager of the Linden, N. J., Warners plant of American Cyanamid Co. Formerly with the industrial chemicals division's New York production department, American Cyanamid. Joined the company in 1929 as a chemical engineer in the production department.

Roger Magoun. From assistant economist to economist, Norton Co., Worcester, Mass. Joined the company's abrasive division in 1928; transferred to the grinding machine division in 1929 as planning engineer, became production engineer and then production manager.





E. Magoun

R. Luckey

Robert C. Luckey. Safety engineer, chemical plants division, Blaw-Knox Construction Co. Has had extensive safety engineering background in powder plants, petroleum refining, fire prevention and related phases of safety and security programs. Graduate of Northwestern.

James Cooperman. Research chemist at Armour Research Foundation, Illinois Institute of Technology. Formerly development chemical engineer for Southern Natural Gas Co., Pittsburgh, Pa.

# NO TIME FOR INTERRUPTION



Engineers who want to make their separation process continuous don't have to "fish" for the way to do it. By installing De Laval centrifugal machines, they can reduce to seconds operations that formerly, with gravity or inefficient filters, took minutes or even hours. They eliminate interruptions.

Specific examples of time saved — and product improved — with De Laval Separators and Clarifiers come from every branch of the process industries. Here is a man who wants to separate penicillin from solvent. Here is another who wishes to remove pigment particles from varnish. Still another needs to remove solids from hot wort in brewing beer. In each instance, the proper De Laval centrifuge solved the problem, speeded up the process and improved the product.

What we want to suggest is — what De Laval engineering and De Laval centrifuges have done in these instances, they may well do in your own case.



Poughkeepsie, New York 427 Randolph St., Chicago 6 DE LAVAL PACIFIC CO. 61 Beale St., San Francisco 5 THE DE LAVAL COMPANY, Limited Peterborough, Ont.





for Speeding Production by

CONTINUOUS

Separation and Clarification

FOR SEPARATION . CLARIFICATION . CONCENTRATION



And since you can once more turn to Nylon Cloth, it might be well to review its outstanding filtering values:

- · highly resistant to most common alkalies, common organic acids and many other chemicals.
- highly resistant to heat; permissible temperatures up to 250°F; its superiority pronounced in the 200°-250° range.
- unaffected by fungi, molds and bacteria; also unaffected when steam-sterilized making it ideal for filtering food products, pharmaceuticals and other products where contamination is a factor.
- · highest tensile strength of all fibers, natural and synthetic; outstanding flex and abrasion resistance factors.
- smooth, non-clinging surface for easy cake discharge.

Before ordering, write us for laboratory test samples to re-check its values for your requirements.



NAMES IN THE NEWS, cont. . .

John J. O'Neill, Jr. Manager of the research and development department of the explosives division, Olin Industries, Inc., East Alton, Ill. With Olin Industries since 1940. Chemical engineering graduate of the Missouri School of Mines.





- M. Morrison Hihn. Research engineer on the executive staff of John Powell & Co. Formerly a chemical engineer with the American Can
- Thomas Reber Stein. Resident manager of Rayonier, Inc.'s new purified wood cellulose plant now under construction at Doctortown, Ga. Formerly resident manager of the Minnesota and Ontario Paper Co.
- Joel H. Hildebrand. Retired as chairman of the University of California's chemistry department which he has served continuously since 1913.
- A. Schubert Kloss. Retired as manager of production, naval stores department, Hercules Powder Co., a post he has held since 1939. Prior to that, manager of a naval stores plant in Brunswick, Ga., for 19 years. His successor: Frank W. Volk who was superintendent of the naval stores plant at Hattiesburg, Miss.
- Erling F. Rosholdt. Member of the chemical engineering department, Atlantic Research Corp., Alexandria, Va., in the solid propellant group. Previously, materials engineer with Westinghouse Electric & Mfg. Co., transformer division. Before that, administrative head, Sharon Technical Institute, Penn State.
- Joseph S. Milazzo. Assistant plant superintendent in charge of dyestuff

production, fine chemicals division, Pittsburgh Coke & Chemical Co. New assistant supervisor of fine chemical process development: Heinz Gruen. Assistant supervisor of fine chemical research: Henry H. Richmond, formerly research group leader, organic chemicals. Chief colorist to supervise dye standardization: Albert E. Medas.

Wesley S. Coe. Assistant factory manager of the Naugatuck, Conn., plant of Naugatuck Chemical Division, United States Rubber Co. Formerly, chemical production superintendent and assistant to the factory manager. Joined the company in 1936 at its general laboratories in Passaic, N. J. Doctorate in chemistry from the University of Illinois.



1

W. Coe

V. Uhl

Vincent W. Uhl. Manager, process equipment division, Bethlehem Foundry & Machine Co. Joined company in 1946 to design process equipment. Instructor's fellowship, chemical engineering, Lehigh University, 1947 to 1951. Prior to coming to Bethlehem, assistant manager, heat transfer division, Downingtown Iron Works, 1944 to 1946; chemical engineer, development division, Sun Oil Co., 1940 to 1944. Doctorate from Lehigh.

Charles P. Loucks. Production manager, eastern clay products department, International Minerals and Chemical Corp.'s industrial minerals division. Joined the department in 1946 as field engineer to the foundry industry. New assistant to the vice president of the industrial minerals division: John D. McKenzie, formerly technical economist and assistant to the vice president of the research division.

Robert S. Shane. With the research and development division, contract research department, Wyandotte

# KIRKAND BLUM...specialists in sheet metal fabrication

FABRICATING for PROCESS INDUSTRIES

Hoppers
Bins
Racks
Boxes
Shop Trucks
Dust Collectors
Hoods
Air Ducts
Fume Exhaust Systems
Dust Control Systems
Air Handling Systems
Bag Loading Systems
Eliminator Housings
Eliminator Plates
Ovens
Dryers
Tanks-Steel

Tanks-Rubber or Lead Lined Pans Stacks Breechings

Guards

Tanks-Non-Corrosive

Whether your specifications call for plating baskets, tanks, fume removal systems or all three . . . KIRK & BLUM has 45 years of manufacturing experience, the men and facilities to produce fabricated items of alloy, sheet or plate steel to ½" thickness.

These fabricating jobs are typical of hundreds made by KIRK & BLUM throughout industry. Put this wealth of experience to work for you . . . send prints for prompt estimate. There is no obligation.



The Kirk & Blum Manufacturing Co. 3208 Forrer Street, Cincinnati 9, Ohio

# U. S. TOBACCO COMPANY INSTALLS RANDOLPH AUTOMATIC FIRE SYSTEM

The U. S. Tobacco Company's large multiple unit dust collector presented an unusual and worrisome fire hazard, but this 150 pound Randolph Automatic System not only automatically detects and extinguishes any fire that might occur in the unit, but also shuts down the dust collector blower, and rings an alarm located on one of the lower floors of the building.

### Kills Fire, Sounds Alarm and Shuts Down Machinery

As in the U. S. Tobacco installation, Randolph Systems, in addition to automatically killing the toughest fires in split seconds, can also be equipped with duct and door closers, motor, fan and machinery shut-offs, warning alarms and other auxiliary safety devices. Systems are designed for both local application or total room flooding and are ideal for dip tanks, baking ovens, spray booths and hundreds of other applications.



Officials of the U. S. Tobacto Co., and the Nashville Fire Department inspect the Randolph Automatic System installed on giant dust collector.



Battery of Randolph CO<sub>2</sub> Cylinders in U. S. Tobacco system.

### Free Catalog and Engineering Service Available Without Cost

Randolph's FIRE HAZARD INDEX gives correct equipment and methods for protection against 590 typical fire hazards. Write for your free copy today. Address: Randolph Laboratories, Inc., 10 E. Kinzie St., Chicago 11, Ill.



NAMES IN THE NEWS, CORT. . .

Chemicals Corp. Former employers: Bausch & Lomb; Amecco Chemicals, Gelatin Products.





G. Goheen

W. Berrell

Gilbert E. Goheen. Director of research and development, J. T. Baker Chemical Co. Formerly associate director of General Aniline and Film Corp.'s central research laboratory. Joined that firm in 1942 following five years' research work for Sun Oil Co. Doctorate from the State University of Iowa. New director of economic studies of new manufacturing fields: Warren M. Berrell. Formerly New York sales representative for the Pfaudler Co. From 1947 through 1949 he operated his own chemical engineering consulting company in Boston. From 1944 to 1947, in charge of process engineering and responsible for initiating and completing a new heat exchange division at Pfaudler. From 1941 to 1944, senior chemical engineer at Merck. Graduate of Worcester Polytech.

John F. McGreevy. Special assistant to the chief engineer, central engineering department, Calco Chemical Division, Bound Brook, N. J. Has been a senior engineer. Joined the company in 1928.

R. H. Gardner. Research associate, Sinclair Oil Corp. Formerly director of lubricants research division for Sinclair Research Laboratories. Joined the company's East Chicago refinery 33 years ago.

Irwin Borsuk. From chief engineer to director of engineering, Wigton-Abbott Corp., Plainfield, N. J. His successor: Walter V. Coleman.

John G. Dean. Director of Columbia's division of cooperative research, the link between its new

# The name POWELL

### is the HALLMARK of dependable flow control equipment



Fig. 2475—150-pound O. S. & Y. Globe Valve. Stem is threaded and guided through a bushing screwed into upper yoke which has a compression lubricant fitting. Seat and plug type disc easily reground if necessary. Conforms to latest standards. Available in a wide selection of corrosion-resisting metals and alloys, with bolts and nuts in stainless steel. Also with screwed ends.

All over the country, in Chemicals and Process plants, you will find Powell Valves in bronze, iron, steel and an amazingly wide range of corrosion-resisting metals and alloys. But regardless of type, size, design or material, they all have an outstanding characteristic—dependability. This means unfailing, trouble-free performance, with minimum maintenance, under even the most exacting service conditions.

You, too, can enjoy the best in flow control with valves bearing the name "POWELL."

### The Wm. Powell Co., Cincinnati 22, Ohio



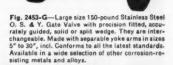
Fig. 559—125-pound iron Body Bronze Mounted Swing Check Valve with flanged ends, bolted flanged cap and regrindable, renewable bronze seat and disc. Disc, when wide open, permits full, unobstructed flow through valve body.



Fig. 2107—Flanged end O. S. & Y.
"Y" Valve for 150 pounds W. P. Can
be furnished in various corrosion-resisting metals and alloys with bolts
and nuts in stainless steek Flange
dimensions and wall sections
conform to all the latest
standards. Sizes ½" to
2", incl. Also
available with
screwed ends.



Fig. 2608—200-pound Bronze Globe Throttling Valve that permits FULL FLOW through seat when wide open, thus reducing turbulence and pressure drop to a minimum. Special bronze stem and stainless steel disc and seat hardened to approximately 500 Brinell.



## **POWELL VALVES**

In Bronze, Iron, Steel and Corrosion-Resisting Metals and Alloys.

### YOUR DIFFICULT SEPARATIONS solved

### CLASSIFICATION

**Small particles** recovered in the overflow with no stray coarse particles.

Oversize particles separated into the underflow.

### SOLUBLE RECOVERY

Mother liquor separated from solids with minimum loss or dilution.

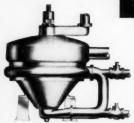
Rejected solids stripped of valuable solubles by Merco's counterflow wash.

### CONCENTRATION &

Suspended solids concentrated and washed free of contaminating solubles.

### WASHING

Rejected liquor carrying the solubles from the original feed.



The Merco Centrifugal Separator is a fast economical means to achieve separations that are tedious or impossible by other methods. Here are typical examples: classifications at particle sizes as small as 1 micron; soluble recoveries as high as 99.9% in one stage (with immiscible wash); and concentration of solids to as high as 65% dry substance. Fully continuous operation and high efficiency in these and other separations result from Merco's unique Return Flow.



Feasibility and economics of the Merco for your particular separation problem can be determined by laboratory tests and pilot plant evaluations. Inquiries receive prompt attention.

Write today for bulletin C-27 and application data

### MERCO CENTRIFUGAL CO.

AFFILIATE OF THE MERRILL COMPANY, ENGINEERS 150 GREEN STREET \* SAN FRANCISCO \* CALIFORNIA NAMES IN THE NEWS, cont. . .

engineering center and industry. Formerly in charge of the industrial chemicals research division, International Nickel Co. Studied at Brown and Columbia.

David N. Hauseman. Vice president, Davison Chemical Corp. Continues as a marketing executive. Came to the company in January after resigning as president of Houdry Process Corp. Studied at MIT and Harvard.

John M. Campbell. Assistant technical director on the general manager's staff, General Motors Research Laboratories. Formerly head of the organic chemistry department. Joined GM research in 1926 as a member of the fuel section. Graduate of MIT. His successor as head of the organic department: Lloyd L. Withrow, formerly assistant head of the department.

William G. Van Beckum. Head of chemical byproduct development, Pacific Lumber Co. Since 1948, manager of technical service and assistant sales manager, special products division, Weyerhaeuser Timber Co. Joined Weyerhaeuser in 1942 as chief of the chemistry section, development department. Studied at St. Norbert College and the University of Wisconsin.

Donald R. Guthrie. Executive engineer in charge of engineering research, Minnesota Mining & Mfg. Co. Joined 3M as a research chemist in 1939. Made a division engineer in 1944. Chemical engineering graduate of the University of Iowa.



W. Van Beckum



D. Guthrie

T. V. Monahan. Chief of the chemicals branch of the Rubber, Chemicals and Drugs Division, OPS. Assistant treasurer of Rohm & Haas.

- H. K. Booker. Transferred from North American Cyanamid Ltd. of Canada to Chemical Construction Corp. in New York. Both firms are units of American Cyanamid. In his new post he will work on design and construction of numerous ammonia plants throughout the world. Studied at McGill.
- John D. McKenzie. Assistant to the vice president, industrial minerals division, International Minerals and Chemical Corp. Formerly technical economist and assistant to the vice president of the research division. Chemical engineering graduate of Purdue.
- L. C. Chamberlain. Assistant to the director of research, Dow Chemical Co. Has been manager of research for the company's plastics department since 1945. Joined the company's physical research laboratory in 1928; became assistant director in 1941. Tulane graduate. His successor in the plastics department: Raymond F. Boyer, formerly director of the physical research laboratory. Boyer's successor: W. C. Bauman, formerly assistant director of the laboratory.





L. Chamberlain

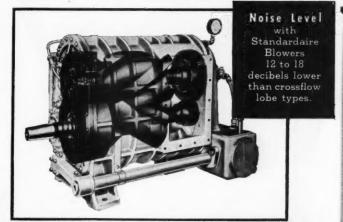
C Davis

- C. Manning Davis. Head of the analytical section of the research laboratory, International Nickel Co., Bayonne, N. J. From 1947, engaged in research on pilot plant opeartion, organic synthesis and organic analysis at Mellon Institute. Prior to that, in charge of the analytical laboratory of Fisher Scientific Co., Pittsburgh, Pa. Doctorate from the University of Pittsburgh.
- Marvin O. Shrader. Supervisor, organic chemical research, research and development department, Pittsburgh Coke & Chemical Co. Formerly with General Aniline & Film Corp. for ten years. Doctorate in organic chemistry from Yale.

# MUST BLOWERS BE LOUD OR

### QUIET

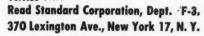
### Like a STANDARDAIRE



### STANDARDAIRE QUIETNESS MEANS LESS WEAR--MORE AIR

MPARTIAL tests have proved conclusively that Standardaire Blowers with their smooth, gradual delivery action minimize shock and sound pulsations . . . a distinct contribution to quiet operation. Then too, the noise level does not noticeably increase with higher pressures. With the Standardaire principle you squeeze the air gently instead of slapping it . . . a feature that eliminates shock load on the internal parts of the blower. This, of course, means less wear and prolongs service life, even under severe operating conditions.

Write ....



**BLOWER-STOKER DIVISION** 



CORPORATION

**NEW YORK · CHICAGO · ERIE · YORK · LOS ANGELES** 

# Cross out those nightmares about special tools and intricate installations



SARAN LINED steel pipe

#### RELATED PRODUCTS

Saran rubber tank lining. An outstanding lining which resists grease, many solvents, acids and other chemicals.

Saran rubber molded parts. Stoppers, diaphragms, various-sized moldings for valves, instruments, etc. and threaded in the field without the need for special tools or handling, costly downtime can be reduced to a minimum. Moreover, the dependable, long-term service and excellent corrosion resistance of saran lined steel pipe keep maintenance costs low. Rigidity and pressure strength are additional advantages. Wherever piping with unusual resistance to most chemicals and solvents is indicated, install saran lined steel pipe. Reduce shut-down time and costly equipment replacement. Saran lined steel pipe is manufactured by The Dow Chemical Company.

Write to the Distributor:

### Saran Lined Pipe Company

2415 BURDETTE AVENUE • FERNDALE, MICHIGAN Offices in: New York • Boston • Pirthsburgh • Tuks Philadelphia • Chicago • Forthand • Indianapolis • San Francisco • Houston • Deriver • Los Angeles • Saottle Cleveland • Charleston, S. C. • Toronto • Montreal

Saran Lined Pipe Company,
2415 Burdette Avenue, Ferndale, Michigan
Please send me a copy of your cotalog on
Saran Lined Pipe, Valves and Fittings.

Name.

Company

Address.

City

State

SP-502D

Names in the News, cont. . .

C. E. Libby. To organize a curriculum in papermaking at the University of North Carolina. Formerly, professor, pulp and paper manufacture, State University of New York college of forestry.

Forrest O. Calhoon. Technical advisor to the vice president and general manager, tar products division, Koppers Co., Pittsburgh, Pa. Has been president of the Disco Co., division of Pittsburgh Consolidation Coal Co., since 1948. Associated with Koppers from 1927 to 1948. Chemical engineering graduate of the University of Missouri.

John S. Leach. President of the Texas Co. Has been executive vice president since 1951, a director since 1949.

James T. Akehurst. General superintendent, Archer-Daniels-Midland's oil refining operations. For the past 10 years, superintendent of six ADM refineries producing oils and fats for the company's chemical products and foundry products divisions. Started with the company in 1931 in its Wyandotte, Mich., plant; from 1933 to 1942, plant superintendent.

A. E. Bailey. Winner of the Herty Medal for outstanding contribution to chemistry in the South presented by the Georgia section of ACS. Research director of the Humko Co., Memphis.

Don L. Horridge. Manager, planning department, Catalytic Construction Co., Philadelphia. Previous positions: vice president of Tears Engineers of Dallas; chief draftsman for Process Engineers, Inc. of Dallas and the Gasoline Plant Construction Corp. of Corpus Christi. Studied at Southern Methodist University.

Michael J. Curry and Alan K. Jeydel. Product development engineers, product development department, Celanese Corp. of America. Mr. Curry: joined the company in 1950; previously an assistant professor at the College of St. Thomas, St. Paul, Minn. Doctorate from the University of Wisconsin. Mr. Jeydel: formerly with Pennsalt. Studied at RPI and MIT. New technical service engineer: G. H. Wiech. Previous employers, Crucible Steel, Congoleum-Naim Chemical.

If you've never used this -



### maybe you should

The new Helically-corrugated Seamless Flexible Tube

If you have a process or application involving flexible metal hose, it will pay you to know a few facts about UNIFLEX. For this entirely new, seamless flexible tubing is just coming into its own—in applications too critical for ordinary concentric tubing.

#### Consider . .

- 1. We make UNIFLEX from seamless, special bronze alloy tube—tough, corrosion-resistant, leak-proof.
- 2. Helical corrugations give UNIFLEX greater flexibility and longer life. Our unique method of manufacture eliminates embrittlement resulting from excessive work-hardening.
- 3. For leakless service, UNIFLEX fittings have metal-to-metal seat. Seal is produced through spring washer effect of hose on fitting body.
- 4. Unlike conventional split-ring collars used on concentric tubing, the one-piece UNIFLEX collar hugs 4 or 5 convolutions. This means far less wear—and much greater strength in the connection.
- 5. UNIFIEX is encased in hightensile bronze wire braid attached to specially designed couplings. Hose is relieved of damaging strains; sheath prevents elongation, gives extra safety, withstands abrasion.
- 6. UNIFLEX helical construction distributes flexing between inner and outer surfaces of convolutions —eliminates strain usually limited to one groove. Result: Greater safety and longer life.
- 7. UNIFIEE fittings are shorter and more compact than most others. This permits the use of more hose length and less fitting length gives far greater maneuverability, makes it easier to get in and out of tight places.

Unifiex is supplied in measured lengths, properly fitted and ready for use. You can buy it in sizes from 1/4" to 6" ID. It has already proved itself in such applications as hydraulic lines, oil burners, refrigeration machinery, air conditioning equipment, pumps, compressors, diesel

engines and machine tools. Our Designers and Engineers have a thorough knowledge of its behavior under exacting conditions. If you'd like to know what UNIFLEX can do for you write us about your problem. We'll be glad to help you—without obligation.

Send for your free copy of our new UNIFLEX Catalog, it contains full technical data, sizes, filtings, suggestions for use, and information about new UNIFLEX Quick-soldered Couplings...



Note the Helically-corrugated, seamless wall structure of UNIFLEX.



UNIFLEX vibration eliminator used between circulating coils and compressor of a General Electric air conditioning unit. Motor-compressor unit is spring-mounted, requires a flexible connection.

← Let Our	Family of	Products	Help You	Titeflex
SEAMED AND	GALLE		ş	TITEFLEX, INC. 504 Frelinghuysen Ave. Nework 5, N.J. Please send me without cost information about the products
SEAMLESS METAL HOSE	PRECISION BELLOWS	IGNITION HARNESS	IGNITION SHIELDING	checked at the left. NAME TITLE FIRM.
ELECTRICAL CONNECTORS	RIGID AND FLEXIBLE WAYE GUIDES	FILTERS	FILSES	ADDRESSZONESTATE



The Haloid Company, prominent
Rochester, N. Y. photographic paper manufacturer,
installed Kathabar humidity conditioning equipment to
supply dry air for continuous tunnel drying of emulsioncoated photographic paper. Kathabar replaced conventional air
conditioning equipment and saves Haloid \$40,000 annually.
In addition to improving Haloid's product quality, the
Kathabar equipment paid for itself in the first year. Kathabar is
providing substantial savings for other chemical manufacturers, too, and daily is preventing costly caking and
accumulation of explosive fumes and dusts.
LET US SEND YOU informative case histories as well as
"The Humidity Engineer." These studies will tell you what
Kathabar has accomplished for others. They may give

Surface Combustion

Surface

TOLEDO 1. OHIO

Send me case histories and complete information on Kathabar humidity conditioning equipment.

Send me information on (Write here any special humidity problem you may have)

NAME.

COMPANY.

ADDRESS.

CITY.

ZONE.

STATE.

NAMES IN THE NEWS, cont.

George Sachs. Director of the metallurgical research division, institute of industrial research, Syracuse University. Also research professor of metallurgical engineering. Continues as vice president of Horizons, Inc., Cleveland. Previous employers: Case Institute of Technology; National Metallurgical Laboratory in India: Metals Research Assn.

#### **OBITUARIES**

Wallace A. Gilkey, 54, chemistry instructor at the Sacramento, Calif., Junior College, died in Sacramento June 24. Doctorate in chemical engineering from Stanford.

Eugene C. Auchter, 62, director and president of the Pincapple Research Institute of Hawaii, died in Honolulu July 8. Before World War II he was agriculture research administrator for the U. S. Dept. of Agriculture.

Frederick H. Lane, 69, Hercules Powder Co. consultant on protective coatings for 28 years, died July 12 in Sarasota, Fla. Chemistry graduate of Brooklyn Polytech.

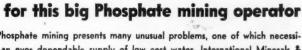
Claude L. McKesson, 71, nationally recognized authority on bituminous paying, died July 21 at Altadena, Calif. He joined American Bitumuls Co. of San Francisco in 1928 as vice president in charge of engineering and director of research and was active in this company and its successor, American Bitumuls & Asphalt Co., until 1946 when he retired to a consulting capacity.

Lammot du Pont, 71, former president of E. I. du Pont de Nemours & Co., died July 24. He was president of the company from 1926 to 1940; chairman of the board from 1940 to 1948.

Walter A. Schulze, 52, member of the research planning board of Phillips Petroleum Co., died in Bartlesville, Okla., July 30.

Alonzo W. Gearhart, 75, board chairman of Sunland Refining Corp, died August 4 at Fresno, Calif. He was president of Sunland from 1927 to 1948.





Phosphate mining presents many unusual problems, one of which necessitates an ever dependable supply of low cost water. International Minerals & Chemical Corporation, on their big phosphate mining operations near Bartow and Orlando, Florida, are now using nine complete Layne well and pump units. These installations have a total maximum capacity of nearly thirty-thousand gallons of water per minute—enough for greatly increased mining activity.

And so here again we have a case of where water supply failure would stop everything—and where the owner had to be sure that he was buying the utmost in proven dependability, low cost operation and the kind of quality that would assure long life.

But the decision was easy. Layne water supply wells and pumps have an unmatched record of making good on every job no matter how heavy the production, or how long the hours may be. Whether for a mining operation, a city, factory or irrigation farm, Layne wells and pumps always give complete satisfaction and cost less in the long run.

LAYNE & BOWLER, INC.
General Offices, MEMPHIS 8, TENNESSEE



If you are contemplating the installation of water wells or pumps, it will be worth your while to have copies of our water supply or pump catalog. Write for copies. No obligation.

WATER WELLS
VERTICAL TURBINE PUMPS
WATER TREATMENT

### NEW LINES



Atlas Mineral Products Co., Mertztown, Pa.—A rigid plastic material available in such forms as the typical exhaust system shown above which was specially designed and fabricated for a large Eastern chemical company. The material is available as extruded pipe with molded fittings, formed containers and fabricated tanks as well as square and round duct sections in standard sizes. Non-standard units can also be designed, engineered and fabricated at the Mertztown plant.



Tewes-Roedel Plastics Corp., Waukesha, Wis.—Plastic tote-boxes made from copolymer sheeting said to be characterized by unusual impact strength, light weight, and resistance to common acids, oils and greases.

Beckman Instruments, Inc., South Pasadena, Calif.—Digital counting equipment through the acquisition of Berkeley Scientific Corp., Richmond, Calif. Beckman itself manufactures analytical instruments.

Ideal Industries, Inc., Sycamore, Ill.— Electrical tapes including a fourcoated, ravel-free friction tape, a quick-fusing, high-dielectric rubber tape, a two-in-one plastic tape. The tapes have a vinyl plastic body and a dielectric strength of over 8,000 v. They are said to resist acids, alkalis, corresive salts, water, oils, greases and alcohols.

American Potash and Chemical Corp., Los Angeles – Insecticides, soil fumigants and refrigeration chemicals through its acquisition of Eston Chemicals, Inc. The latter's manufacturing facilities are located at Vernon and Torrance, Calif.

### **NEW NAMES**

Lindsay Light & Chemical Co. has changed its name to Lindsay Chemical Co. It is located in West Chicago, Ill.

### **NEW COMPANIES**

Syntron Ltd., a Canadian subsidiary of Syntron Co. of Homer City, Pa., to manufacture the parent company's vibratory material handling and other equipment in Canada. Production is scheduled to begin this fall.

Columbine Pulp and Paper, Inc., Denver, to produce newsprint in western Colorado. A plant will be built between Grand Junction and Glenwood Springs.

### **NEW LOCATIONS**

Morrison Industries, Inc., designers and builders of industrial process equipment, has moved to 17100 Miles Ave., Cleveland.

Heyden Chemical Corp. has moved its executive offices to 342 Madison Ave., New York.

### NEW REPRESENTATIVES

Carlon Products Corp., Cleveland plastic pipe manufacturer, has appointed Green Contracting & Engineering Co., Wichita, Kan., as the oil country sales division of the organization.

Chemical Development Corp., Danvers, Mass., which manufactures a

complete line of products for the plastic and allied industries has just appointed Allied Products Engineering Corp., Los Angeles, as its representative in California.

A. O. Smith Corp., Milwaukee, has appointed Donie Engineering Sales, Inc., Indianapolis as manufacturers' agent for distribution of its safety grating in Indiana.

American Resinous Chemicals and American Polymer Corp. have appointed Vulcan Sales Co., Kansas City, Mo., as agents in Iowa, Nebraska, Kansas, Oklahoma, northern Texas and western Missouri.

Witco Chemical Co., New York, has appointed Kenneth H. White Co., Detroit, as agent for its naphthenate, tallate and octoate driers in the Detroit area.

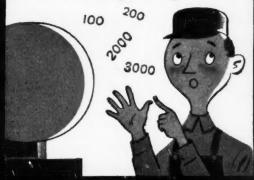
Ampeo Metal, Inc., Milwaukee, has appointed H. J. Shockey and Associates, Dayton, as exclusive distributors in the Dayton area for its resistance welding products.

### NEW FACILITIES

American Reinforced Paper Co.—A new \$500,000 plant at Tracy, Calif., for manufacture of waterproof, reinforced papers for building and industrial uses. It will be ready to serve western states early in 1953.

Owens-Corning Fiberglas, Pacific Coast Division—The facilities of the Marine Engineering Supply Co., Los Angeles, which it has purchased for over \$2.5 million. The firm will be taken in as the Marine Engineering division of Fiberglas Engineering & Supply Co., San Francisco subsidiary established in 1950. Marine Engineering distributes and installs insulation products.

Richfield Oil Corp.—Expanded facilities costing \$40 million at its refinery near Long Beach, Calif. The project, including a fluid catalytic cracking unit said to have a larger No "Waste - Time"
Weighing...



WITH

### FAIRBANKS-MORSE

You speed your weighing operations with Fairbanks-Morse Bench Dial Scales. And that means there are no "bottlenecks" to hold up production all through your plant. Here's why:

With Fairbanks-Morse Bench Dial Scales, weights are read right at the point of the indicator. No time-wasting mental calculations are needed. You can weigh as fast as material can be moved on and off the scale platform. And, easy-to-read charts plus elimination of mental calculations reduce the possibility of human error . . . stop profit-eating weighing lösses.

To eliminate "waste time" weighing in your operations, consult your Fairbanks-Morse weighing expert. Or, if you prefer, write Fairbanks, Morse & Co., 600 S. Michigan Ave., Chicago 5, Ill.





FAIRBANKS-MORSE,

a name worth remembering

SCALES - DIESEL LOCOMOTIVES AND ENGINES - ELECTRICAL MACHINERY - PUMPS HOME WATER SERVICE EQUIPMENT - RAIL CARS - FARM MACHINERY - MAGNETOS What is TEFLON?
Teflon is a plastic material with these unique properties...

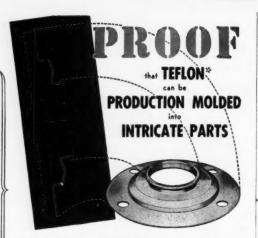
 CHEMICAL INERTNESS
most chemically inert of all plastic materials

 WIDE TEMPERATURE RANGE
continuous service up to 500° F, also to -100° F

- NON-ADHESIVE
- . LOW COEFFICIENT OF FRICTION
- ZERO MOISTURE-ABSORPTION
- DIELECTRIC
   PROPERTIES

even at high temperatures and high frequencies

WEATHER-



Since its introduction, Teflon's unique qualities have made it desirable for a multitude of applications. The one limiting factor has been the difficulty of production molding Teflon into any but the simplest forms. Sparia has overcome this difficulty.

### Bring your Teflon molding problems to Sparta

Sparta has proven that Teflon can now be production molded into shapes far more intricate than had been considered possible. Sparta "know how" is the answer to your Teflon molding problems.

"DU PONT'S TRADEMARK FOR ITS POLYTETRAFLUGRETHYLENE RESIN

### SPARTA HEAT TREAT CO. EAST SPARTA CHILD PLASTICS DIVISION

BASIC FACTS, MAN-MADE MINERAL

Electro-Carb (SILICON CARBIDE)
WRITE FOR SPECIAL REFRACTORIES
8-749

Learn
THE BASIC FACTS
before deciding
on type of
REFRACTORIES



Because certain types of refractories have been used a long time IS a valid reason for investigating Electro-Carb at this time.

Especially so when Electro-Carb made Refractories, used for heat transfer, for example, showed a measurable 10-times increase in efficiency.

Facts and figures in almost telegraphic brevity are contained in Bulletin B-749. Sent on companyletterhead request. If you have a problem concerning the use of silicon carbide refractories, please submit it at the same time.

Electro Refractories & Abrasiers Corporation

INDUSTRIAL NOTES, cont. . .

capacity than any similar unit on the West Coast, is scheduled for completion during 1954.

Froedtert Grain & Malting Co., Milwaukee-Malt laboratories, now in full operation for scientific control of quality and for malt research.

Sinclair Refining Co., New York—New facilities in Houston which has already begun tank car shipments of light and heavy odorless solvents to the paint industry.

Carnation Co.—A research center in Van Nuys, Calif., to cost \$500,000. It will combine activities now carried on at the company's laboratories in Oakland, Calif., Milwaukee and Oconomowoc, Wis.

Atlas Powder Co., Wilmington, Del.— A new office in Houston to service southwestern users of its industrial chemical products.

Institute of Paper Chemistry—A new building to serve as a general activities center at Appleton, Wis. To cost \$350,000 it should be completed by mid-1953.

W. J. Voit Rubber Co.—Λ \$400,000 plant in Portland, Ore., manufacturing automobile rubber products, principally processed rubber for tire recapping and retreads.

H. K. Porter Co., Pittsburgh, Pa.—A stock-carrying branch warehouse and sales office for its Quaker Rubber Corp. division in Minneapolis.

California Reinforced Plastics Co.—A building in Oakland, Calif., which will increase production capacity for the company's new ½ in. celled aluminum honeycomb and preshaped glass fabric honeycomb for radomes and other curved surfaces.

Vitro Chemical Co.—A \$1.1 million expansion program at its Salt Lake City plant that will enable milling 300 tons of non-vanadium type uranium ores daily.

Allis-Chalmers Mfg. Co., Milwaukee—
A plant in Cincinnati to provide additional space and shipping facilities for Texrope drive equipment.

—End

### NEW CLOTH SCREEN DUST FILTER

provides continuous and uniform suction



After extensive laboratory tests and observance of over 30 units in actual operation for the collection of a large variety of dust in various industries, the W. W. Sly Manufacturing Co. of Cleveland, Ohio, is now promoting the sale of a cloth type dust filter which offers a number of advantages, over existing units, such as: (1) constant uniform suction at the dust source, (2) no mechanical shaking, (3) continual cleaning of the filter bags, and (4) longer bag life.

The usual sheet metal case contains a number of cloth filter bags. A fan creates the suction which draws the dust-laden air into the case. The air passes through the filter bags which retain the dust.

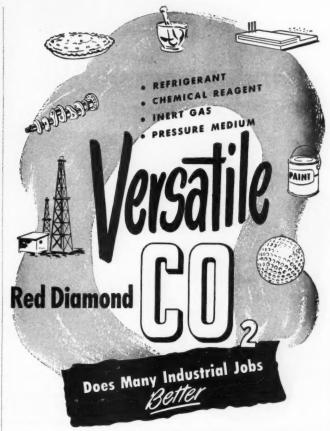
In order to maintain peak efficiency, the dust must be removed from the filter cloth. Here's how it's done (patented): With the filter case under suction, a device which travels back and forth over the open ends of the filter bags, has a flexible hose leading to the outside of the filter case. The suction on the case will draw atmospheric air up into the traveling device and in reverse direction through the filter bag which happens to be opposite the device. This reverse flow of air removes the dust from that bag and lets it drop into the hopper under the filter case.

This new dust collector is called the SLY DYNACLONE. The principle of operation of this SLY DYNACLONE is described in Bulletin 101. Requests for this bulletin and information on application of this design should be addressed to

THE W. W. SLY MANUFACTURING CO.

4771 TRAIN AVE. CLE

CLEVELAND 2, OHIO



Versatility, plus dependable purity... that's the key to the success of Red Diamond CO<sub>2</sub> in filling so many increasingly diverse needs of industry... and doing it better. In refrigeration, in chemical processing, as a pressure medium and as an inert gas, the many uses of Red Diamond CO<sub>2</sub> is constantly expanding.

Complete technical service on request. Conveniently available to industrial users everywhere.

GAS • LIQUID • SOLID

WORLD'S LARGEST PRODUCERS OF CO2

A National Network of Service

THE LIQUID CARBONIC CORPORATION

155 Four 44th 51, New York 17, N Y



For certified data on individual grades of Stainless Steel, use

### BLUE SHEETS

There is a Blue Sheet for each individual grade of Allegheny Metal, giving full information on its physical and chemical properties and characteristics. Let us send you this certified, laboratory-proved data on the stainless grades in which you are interested.

ADDRESS DEPT. C-33

### WRITE FOR YOUR COPY!

For any job which involves the handling of large volumes, heat and high pressures—either singly or all at one time—Allegheny Metal solid or clad plates are produced in the exact stainless grade required to combat corrosion, oxidation and contamination of the product.

Some of these grades are new . . . comparatively recent developments of our research and experience as a pioneer and leader in stainless steel production.

Others are improved versions of older analyses. The latest information on the entire subject of stainless plates is available to you in the booklet illustrated above—32 pages of valuable data on types, sizes, finishes, fabricating methods and uses, including ASTM and ASME boiler codes.

Specify "Allegheny Metal" for complete reliability in stainless steel plates, and write for your copy of the A-L Plate Book. 

Address Allegheny Ludlum Steel Corporation, Oliver Building, Pittsburgh 22, Pennsylvania.

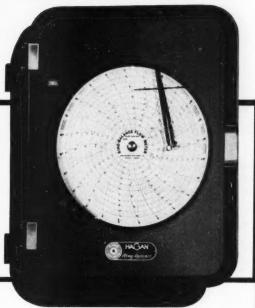
You can make it BETTER with Allegheny Metal



# When you specify HAGAN RING BALANCE FLOW METERS

you are buying

- \* DEPENDABILITY
- \* VERSATILITY
- \* ACCURACY



# features of HAGAN RING BALANCE METERS include:

Hagan Ring Balance Meters are simple in design, rugged in construction. Whatever your metering problems, our engineers are at your service. For full information, get in touch with

- No stuffing boxes or pressure-tight bearings
- Excellent response at extremely low flow rates
- Mercury level not critical
- Ease of dead-weight calibration

# HAGAN CORPORATION

HAGAN BUILDING
PITTSBURGH 30, PENNSYLVANIA



Hagan Bui	lding	g •	Pi	Lti	sb	ERI	rg	h	3	0,	F	e.	n	m	ву	h	a	n	ia	i											
Please send	me	furt	he	e i	inf	OI	rne	ıa	tic	on		DEP	1	H	ag	gai	n	B	tio	ng	, 1	Ba	ala	ar	10	e	N	1e	te	re	A
I am particu	darly	int	lero	est	ted	i	n									* 1				×				. ,							
NAME				× .										×		×									* 1						
POSITION																															
COMPANY																															,
STREET AND	NUM	BER	1									* *																			
CITY					* 1									Z	)1	Œ					87	FA	T	E.							

# Quotes, Extracts and Digests Edited by A. S. O'Brien, Sr.

## **EDUCATING ENGINEERS**

# ... On What Level?

"I favor a single undergraduate chemical engineering curriculum directed toward the broader basic studies and I am against adding one seeking professional specialization at the undergraduate level."—James H. Boyd, professor of chemical engineering at Columbia University.

## MOVING FLUIDS

# ... Watch Your Temperatures

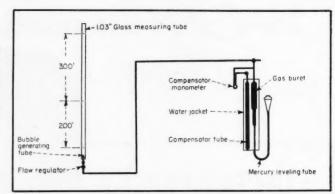
In a recent issue of Oilways, house organ of Esso Standard Oil, a technical editor told how an Esso salesman solved a tricky problem for one of his customers.

Problem—In a paint factory a solvent is pumped from a 10,000-gal. underground storage tank through 2-in. pipe to a kettle on the fifth floor of the building. Pressure in the feed pipe which should be 50 psi. increased to as high as 240 psi. The pressure relief valve was blown open frequently, causing production delays and fire hazards.

The pump runs only a few hours a day. When the pump is shut down and the check valve and line valves are closed, the solvent line from storage tank to delivery point is left full.

Solution—After checking the pumping system for restrictions, hot spots, check-valve sticking and other possible causes, the Esso salesman found every part of the system in satisfactory order. But he also discovered that the last tank car of solvent, an Esso product, had been unloaded when the outdoor temperature was 15 deg. F. and the indoor temperature 65-76 deg. F. He concluded that the temperature rise probably caused the difficulty.

To correct things, the paint kettle was filled with the required amount of solvent, and the valve in the line near the kettle was closed. A valve at the bottom of the line was also closed. As a result, the solvent could be trapped in the pipe between storage tank and kettle. A bleeder line was installed in the pipe so the trapped solvent could be drained back into the storage tank.



DIME STORE APPARATUS for mass transfer in gas bubble-liquid.

# Select an Inexpensive Research Project

By dollar-wise planning, you can hold down research costs. Profs at the University of Tennessee really know how. You may find their ideas stimulating.

In many universities today, the researchers in chemical engineering are up against it. With expenses high and income low, the universities can't seem to finance projects themselves. State legislatures particularly, which have been the breadwinners for endowment-poor state universities, have become cost conscious when asked for appropriations. In fact the magicword, research, has had little shine for them in recent years unless it is prefixed by the word medical.

However, private industry and government agencies are supplying funds frequently and graciously; yet many department heads are for from pleased. The projects given them frequently masquerade under the guise of research, but are developmental in nature. They are specific jobs that someone thinks can be done in a university lab better than in an industrial organization.

Although such grants do keep most research staffs busy, and some, even happy, they do not allow the complete freedom for scientific investigation that most universities want.

How can the universities conduct research now-a-days and still keep their independence? Money for supporting fundamental research without any strings attached is virtually extinct. At a recent meeting of the Engineering College Research Council of the American Society for Engineering Education at Clemson, S. C., engineers heard Harold J. Garber, professor of chemical engineering at the University of Tennessee, point out that universities can conduct scientific investigations with a free hand if they will select inexpensive projects to work on.

"With proper selection of research topics, good investigations that are cheap to conduct can be carried out even in poverty stricken schools," says Garber.

## Costs are high...

Research costs today in universities and industry are running a fever. Most research groups are laboring with elaborate experimental equipment. Just glance at the current technical literature published by various engineering societies, Garber says.

According to Garber, most expenses for unsponsored research goes into equipment, space, materials and special apparatus. Therefore we cut cost by working on problems of a simple character. We selected projects that required small amounts of apparatus, preferably standard instructional items, or that which can be fabricated by the student himself. One such kind is the so-called armchair research project, which eliminates equipment costs entirely and moves the laboratory into the library.

Unfortunately, top-notch students endowed with superior analytical skills, a commodity not abundently bestowed, are needed for library research. As an alternative, we worked up projects that are highly instructive, dignified, of value to the profession and humanity, and actually inexpensive.

## But this project beat costs

One such example was a long range investigational program initiated in 1950 at the university on mass transfer in gas bubble-liquid systems:

To start off with, we decided to determine the diffusional phases of the problem. To get an estimate of the contact time between gas bubbles and liquids—a quantity required for the evaluation of the diffusion occurring on a plate—it is necessary to know the fluid depth on the plate and the bubble velocity through the liquid.

To investigate single gas bubbles through liquids, dime-store type apparatus, and materials already on hand were used (see above). Odds and ends of glass and rubber tubing, and 22 gal. of assorted liquids were purchased.

"The work accomplished thus far in tackling the over-all, long range mass transfer program indicates quite emphatically that high-grade and significant research can be carried out cheaply." The results of the investigation were reported last March by Professor F. N. Peebles at the Atlanta meeting of the AIChE. A number of inquiries on Prof. Peebles work has come in from engineers and scientists in many fields.

Other problems in the long range program are now being vigorously worked on, and with relatively inexpensive equipment. These include velocity determinations on multiple gas bubbles systems and mass transfer rates in gas bubble-liquid systems.

(Continued)

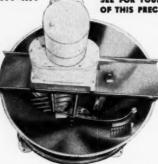




# BORROW this Mixer Kettle... and test it in fout plant

MODEL TA-RA

SEE FOR YOURSELF HOW THE 4-WAY VERSATILITY OF THIS PRECISION MIXER CAN SAVE YOU MONEY



Why guess when you buy mixing equipment? Test first . . . and be sure! Borrow one of our versatile MODEL TA-RA Stainless Steel Steam Jacketed Agitator Kettles for a reasonable time AT NO COST (except freight from and to Chicago or next destination). Then experiment on your own processing. See exactly what speeds you need and what equipment is required to do your work perfectly. MODEL TA-ILA is a special combination of our work perfectly. MODEL TA-ILA is a special combination of our combination of the speed to do your work perfectly. MODEL TA-ILA is a special combination of our combination of the speed drive . . extra-high speed Rota-Therm steam jacket . . and full equipment for excellence in every kind of mixing from violent whilpping to simple stirring, scraping or swirling actions. Using all or parts of the equipment you determine accurately what gives best results. It's a great plan. Write for details now.

Send for FULL DETAILS TODAY!

# GROEMFG. CO

4555 W. Armitage Ave., CHICAGO 39, ILL.
30 CHURCH ST. (MAIS A CENTURY) 420 MARKET ST.
NEW YORK 7 (OF TIME KETTLES) SAN FRANCISCO 11



HUDSON PULP & PAPER CORPORATION
Dept. 131, 505 Park Avenue, New York 22, N. Y.

QED, cont. . .

#### New Equipment and Materials

Water of California	
Pyrex Pipe	\$8.00
Rubber Tubing	3.00
Chemicals	12.00
Precision Clamp	2.50
Supports	11.00

\$36.50

#### Equipment on Hand in the Department (1952 Replacement Values)

placement valu	CB)
Precision Buret	\$31.00
Jacket	4.25
Compensator	11.00
Compensator Tube	2.00
Leveling Bulb	7.00
Stopwatch	20.00
Pycnometer	10.00
Reducing Valve	30.00
Glass Fittings	15.00
	\$130.25

# Equipment on Hand in the University

CHIVERBILLY	
Tensiometer*	\$175.00
Hoeppler Viscosim- eter*	350.00
Abbe Refractiom-	
eter†	375.00
Strobotact	150.00
Strobolux:	200.00
	00 020 18

You can borrow this from: \*The Chemistry Department; †The Physics Department; †The Mechanical Engineering Department

Gas bubble velocity study cost little.

At the same time, other inexpensive research projects are underway in the department of chemical engineering at the University of Tennessee.

They include:
1. Determinati

1. Determination of the electrical contact resistance at steel-mercury and steel-sodium mercury amalgams. This is part of a large project in which we will investigate heat transfer in liquid metal systems, under wetting and non-wetting conditions.

2. Determination of diffusion coefficients in liquid-liquid systems by transient state methods. This is part of the long range mass transfer project.

3. Determination of rates of solution of gases in liquids in gas bubbleliquid systems, and mass transfer coefficients for such systems, also included in the long range mass transfer project.

4. Theoretical considerations regarding transient state radiant heating of thick low conductors—an armchair investigation.

5. Development of differential equations and their solutions for various



Since its incorporation in 1917, the American Stores Company has grown into an organization of over 700 self-service markets and over 1,200 stores employing about 18,000 persons in seven eastern States and the District of Columbia. The 17-acre Philadelphia bakery and warehouse services 900 of the company's Acme self-service supermarkets and American Stores in eastern Pennsylvania and southern New Jersey.

# AUTOMATIC BAKERY

For American Stores' new 17-acre bakery and warehouse in Philadelphia, Graver supplied twenty bins where flours and sugars, conveyed by air suction from specially designed hopper railroad cars, are stored in readiness for automatic mixing. This air-conveyor system-of which the Graver silos are a part-is the first of its kind in any automatic bakery. The battery of Graver-built storage bins has a capacity of 1,200 tons. Each bin is 8' in diameter and 90' high.

It is significant that American Stores should turn to Graver to fabricate these high steel structures, since it indicates once again the wide range of industries which regularly recognize Graver's leadership as a manufacturer of storage vessels of all kinds. Fabricated with utmost care, these bins are one more example of the quality craftsmanship and individual attention which characterize every Graver product.

# GRAVER TANK & MFG. CO.. INC.

EAST CHICAGO, INDIANA

NEW YORK . CHICAGO . PHILADELPHIA . DETROIT . WASHINGTON CINCINNATI - CATASAUQUA, PA. - HOUSTON - SAND SPRINGS, OKLA.





# MULTIPLE WASHING

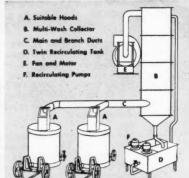
# of most VAPORS and ODORS

If you want the best, most efficient wet-method dust collector working in your plant, specify Multi-Wash.

Schneible parented Multi-Wash system proves that multiple washing rids the air of most dusts, furnes, vopors and gases. Each impingement stage of this cellector provides a double washing action, thus assuring top efficiency. The smallest type J. C. Multi-Wash unit provides 5 separate washes while the larger type V. B. unit washes the air 13 times!

Another important feature—this cellector requires minimum attention—it functions without moving parts or nozzles.

For further information write for bulletin 551 or contact your local Schneible representative.



# **MULTI-WASH**

CLAUDE B. SCHNEIBLE COMPANY

P. O. Box 81, North End Station Detroit 2, Michigan

SCHNEIBLE

PRODUCTS:

Multi-Wash Collectors • Uni-Fie Standard Hoods
• Uni-Fie Compensaring Hoods • Uni-Fie Testionating Hoods • Water Carrior Dupola Collections • Ductwork • Velocitrap • Dust Separaters
• Entrainment Separaters - Settling and Dewatering Tanks • "Wear Proof" Centrifugal Sturry Pumps

QED, cont. . .

consecutive mechanisms in applied chemical reaction kinetics—armchair study.

6. Determination of liquid drop sizes in liquid-liquid systems in connection with studies on extraction.

 Determination of velocities of multiple gas bubble streams in various liquids.

8. Determination of wall effects on the velocity and drag coefficients for single gas bubbles moving through liquids.

Determination of gas bubble sizes during rapid bubble formation.

 Determination of the thermal conductivity of mercury and sodiummercury amalgams.

11. Theoretical considerations of convectional heat transfer in laminar flow in circular tubes—armchair investigations.

# HIRING PERSONNEL

# . . . Fall Brings Draft Rise

Q. When do you think the draft will tighten?

A. It is pretty hard to answer that question without knowing the exact size of the armed forces and be sure that you are on safe ground. My judgment is that, on the basis of the facts as we know them, the really tight time will come in fiscal '55, which will mean beginning July 1, 1954. It should be kept in mind, however, that the situation will become increasingly difficult beginning in September 1952 when we will begin to face our replacement problem. -Arthur S. Flemming, Assistant Director, Office of Defense Mobilization, in U.S. News & World Report.

#### FACING COMPETITORS

# . . . New Methods

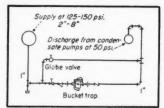
Most people know that Germany, a major competitor of many process industries before the last war, is back on its chemical feet. But what kind of a recovery has it made?

"The recovery of German industry has been spectacular. I reached this conclusion both from visits to plants and by attending a chemical exposition sponsored by German process equipment makers," says Division Head E. W. Forker of Blaw-Knox.

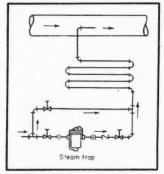
"There is a growing interest in this country in modern facilities for the

production of oxygen. U.S. firms recently placed three contracts for the construction of oxygen plants embodying the modern German Linde processes.

"Among the things I found of particular interest were developments in coal gasification, a new method of purifying gas, recovery of phenol from coke oven effluent, fatty acid distillation, a continuous process for deodorizing vegetable oils, and new techniques for salvaging waste pickle liquors."



PROBLEM: Would this proposed drip connection cause hammer?



SOLUTION: Winner used tempering coils and a curved nipple.

# REDUCING WATER HAMMER

# . . . Solve the Problem

PROBLEM—Editors of Trap Magazine recently asked their readers: (1) In the system sketched above, would the discharge from the drip trap cause hammer when it reached the comparatively cool condensate in the return line? The pumps are sending condensate from low pressure traps back to the boiler room. (2) If hammer is a problem, can you offer any solution?

For the best answer, the editors offered a \$10 award. Of those who replied, 93 percent said there would be water hammer. In fact several contestants showed calculations to prove flash steam would form in sufficient



Take it easy, brother. Don't yell. There's no need to shout or even do anything to stop the flow in fuel and process lines when they are protected by

# **ASCO Safety Shut-off Valves**

(Factory Mutuals Approved)

Perhaps you have an oil or gas burner operating in a rather hazardous location and want an automatic cut off ... or your process lines are carrying fluids (liquid or gas) which if allowed to flow after trouble has developed could cause an explosion... or you are operating vital and expensive equipment which should not continue running if, for example, the lubricating system failed... these are the spots for "Factory Mutuals Approved" ASCO SAFETY SHUT-OFF VALVES. They stop the flow instantly and automatically.

Don't leave the shutting down of lines to the alertness of operators. On every line, use the automatic—sure—electrically operated valves. We have a complete line of such solenoid valves from which to select. Write us in detail concerning your requirements.





We also manufacture a quality line of Automatic Transfer Switches, Remote Control Switches, Contactors and Relays

# Automatic Switch Co.

381 LAKESIDE AVENUE . ORANGE, NEW JERSEY



# HIGH PRECISION Thermistors

from a high precision source



# made to your order for

resistance values • size temperature coefficient • mountings • quality

Widely useful as temperature measuring elements and as liquid level sensors, these temperature responsive resistors are built by Bendix-Friez under a system of quality controls set up to meet exacting military standards of accuracy. You can count on them as the very best obtainable, whether purchased from stock or made to your own specification. Ask for a list of applications.

STANDARD TYPES IMMEDIATELY AVAILABLE

Typical

Typical application in capsule form for temperature sensing of hydraulic oil.

Size (inches)	@ +30°C.	@ 0°C.	@ −30°C.
.140 x ¾	45 ohms	86 ohms	194 ohms
.040 x 1.5	12,250 ohms	26,200 ohms	65,340 ohms
.018 x 1.5	35,000 ohms	82,290 ohms	229,600 ohms

Write for details to Dept. G

FRIEZ INSTRUMENT DIVISION of 1324 Taylor Avenue • Baltimore 4, Maryland Erport Sales: Bendis International Division, 17 Fifth Avc. N. Y. IT. N. Y.



# SILICATE SERVICE FOR CHEMICAL BUYERS



things you can do with PO versatile silicates

Listed below are a few of the many things accomplished with PQ Silicates. Such wide usefulness depends on the different physical and chemical qualities found in PQ's 27 liquid silicates and 16 dry products.

Solidify foundation soils Improve detergent quality of soap and synthetics Laminate paper boards, wall boards Deflocculate and wash clays Depress siliceous slimes in ore flotation Control Oxygen release from peroxides

These uses may suggest applications of PQ Silicates in your processes. Put it up to PQ (90 years' experience in silicate-use tech-

**PO** Silicates of Soda METSO DETERGENTS

Clean metals, paper pulp, etc. Clarify raw and waste waters

PHILADELPHIA QUARTZ CO. 1125 Public Ledger Bidg., Phila., Pa.

nique.)

#### PROBLEM HOW WILL WE



LIQUIDS TO 2.500,000 SSU

LIQUIDS EVEN LP-GAS CAPACITY % GPM

1050 GPM

#### with VIKING ROTARY PUMPS

The simple, positive, "gear within a gear" Viking principle has answered these problems for so many, so well, for so long, there is every good reason to know it will do it better for you.



What are your problems? Send them in today and ask for folder 52SC.



IKING PUMP COMPANY CEDAR FALLS, IOWA

THE ORIGINAL "GEAR-WITHIN-A-GEAR" ROTARY PUMP

QED, cont. . .

quantities to make hammer almost inevitable. However, some reported that, under somewhat similar conditions in their own plant, they had no trouble at all.

SUGGESTED SOLUTIONS-Practically all the suggested solutions could be placed in one of seven categories.

1. Dicharge the trap to the atmosphere. However, the judges of the contest dismissed this as being unnecessarily wasteful.

2. Discharge the trap to a receiver. 3. Discharge the trap to a heat ex-

changer.

4. Discharge the trap to a flash tank.

The last three solutions, while perfectly valid means of avoiding hammer, are unduly complicated and expensive too.

5. Use external radiation. These solutions included long drip legs ahead of the trap, long return lines from the trap, fin type radiation and tempering coils. However, such systems are needlessly expensive, as well as a waste of heat.

6. Use special means of admitting the high pressure discharge into the 50 psi. return header.

7. Use ejectors. Many such solutions were simple, inexpensive. They also wasted no heat; however, there are better ways to prevent hammer.

BEST SOLUTION—To prevent ham-

mer in this system, merely admit the flash steam to the condensate in the direction of the condensate flow. According to the judges, this adjustment should be sufficient.

One reader, however, came up with a remarkably simple hookup and was awarded the \$10 for the best solution. In the winner's sketch, shown here, tempering coils are installed in conjunction with a curved nipple. Although it is not usually necessary, such a set up is a sure cure for hammer.

#### RECOVERING SULPHUR

## . . . Potentially Enormous Resources

"Large quantities of sulphur are available in coal brasses, deposits of calcium sulphate, and in sulphide ores of gold, copper, nickel, zinc and lead. In many instances the economics of recovery are at present unfavorable and ultimate utilization of such

New <u>heat-sealable</u> container for chemicals ...



# VISKON IS ECONOMICAL!

Gives top performance where a "breather" type package is required—at little cost.

# VISKON IS HEAT-SEALABLE!

Generally, VISKON seals at between 350° and 500°F, corresponding with dwell time and jaw pressure.

# ISKON IS STRONG, DURABLE!

Holds its shape, yet is soft and flexible. Has exceptionally high wet strength.

## VISKON IS NON-TOXICE

It's tasteless, odor-free, completely sanitary for use as a container. Lint-free and non-

# @ nonwoven fabrics

. . another product to fit today's needs by

THE VISKING CORPORATION NORTH LITTLE ROCK, ARKANSAS

# ...ideal where porosity, product breathing, absorption, diffusion, infusion and wet strength are needed!

Amazing heat-sealable **VISKON** offers a trend in modern packaging for all types of products needing a "breather" container, yet protects and delivers measured amounts to the user. VISKON is economical, gives top performance with new outstanding features for better consumer acceptance.

VISKON is made of rayon and cotton fibers bonded with cellulose . . . with characteristics ideally suited for packaging. Heat-sealable viskon is non-raveling, lintfree, odorless, tasteless, non-toxic and completely sanitary.

VISKON is furnished in mill rolls, tapes or sheets . . . in a large selection of weights and grades in either cotton or rayon fabric. Whatever your container problem, investigate VISKON today. Mail coupon below for complete information and samples.

Please send more information about VISKON nonwoven fabrics for use as a product container.

THE	VIS	KING	COR	PORA	TION,	Dept.	CC
Box	72,	North	Little	Rock,	Arka	nsas	

Name										×				*		*				,				
Position .						,							×					,						
Company			٠																,					
Address.		 																			,	*		
Citu																								

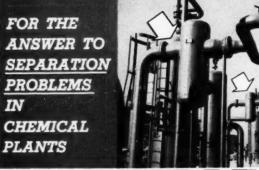
# PIPING PROBLEM

Our skilled craftsmen can be depended on to, give you an installation that will withstand the most severe pressure, temperature, or corrosion conditions. Backed by more than half a century of achievement in the nation's leading process plants, these men can be counted on to meet the most rigid code requirements. Send us the drawings for your next project—we'll be glad to give you an estimate.

Some of the things we can do with Stainless Steel Pipe

## INDEPENDENT FABRICATORS AND ERECTORS





SEE PEBBBS



Shown above are five Peerless line separators on outlet lines from cooling tower efficiently extracting entrained liquid. Performance Guaranteed. Call Peerless to solve your en-



REPRESENTATIVES IN ALL PRINCIPAL CITIES

QED, cont. . .

sources will depend upon research and the development of new techniques and processes.

"However... it has been estimated that the sulphur wasted to the atmosphere as sulphur dioxide from zine, lead, copper and nickel smelting plants has varied from 5.8 million to 8.5 million metric tons annually over the 8-year period 1939-1946. Most of this huge loss, which is equal to three-quarters or more of the world sulphur production in this period occurred in North America.

About 40,000 to 50,000 tons of sulphuric acid are recovered annually from stack gas in nickel-copper smelting at Copper Cliff, Ontario. However, the annual emission of sulphur from the three nickel smelters in the Sudbury region of Ontario may reach as high as 1 million tons. This represents a potential amount of sulphur or acid which could make Canada more than self-sufficient in sulphur requirements, if it were possible to recover most of the sulphur economically."-Moris Katz, Defence Research Chemical Laboratories of Canada.

## COMPUTING EVAPORATION LOSS

# ... Under Specific Conditions

Q. Will you please outline the factors used in computing evaporation losses from a tank under specific conditions of temperature, repair, etc.?

A. Charts give only average losses and may yield misleading results. However, for floating-roof or special tank construction, you will have to resort to empirical relationships. Hence, computations are confined mainly to fixed or cone-roof tanks.

Evaporation losses from fixed-roof tanks are almost directly a function of (1) the amount of liquid surface exposed and (2) the volume of vapor space. Thus, actual losses remain somewhat constant regardless of how full the tank may be, and the percentage loss may vary by more than 100 percent.

During the warm part of the day and during filling, the composition of the gas lost depends on the kind of liquid and the temperature of the liquid surface. Vapor pressure, normally stated as Reid vapor pressure, must be corrected to the temperature of the liquid in the tank and adjusted for inadequacies of the Reid method. The true vapor pressure is usually higher than the Reid by about 10 percent.

Liquid temperature in the tank is about equal to the average atmospheric temperature; however, it does tend to lag toward the temperatures of the preceding days. The lag is generally quite small, usually less than 3 deg. F. But, if the tank is unpainted or rusty, the temperature may be higher by 2 to 5 deg. F.—Oil & Gas Journal, June 23, 1952, p. 111.

# CONSUMING ALUMINUM ... After the Emergency

What are you going to do with all this aluminum when the emergency is over?

"A reasonable question, and, in fact, reminiscent of what we were asked in 1944 and 1945," said Alcoa's Frank L. Magee to members of the Pacific Northwest Trade Association this spring.

"There are several sound reasons for our strong belief in the future of aluminum. Two of them, price and availability, are major considerations, and we think they are in our favor.

"Take price, for example. Aluminum ingot today sells for less than it did in 1939. Compare that with the prices of other base metals, which have risen from 118 to 280 percent since 1939.

"Aluminum now costs less per pound than copper, zinc, tin or lead and substantially less than any of the non-ferrous metals on the basis of equal volume.

"The increased productive capacity of the aluminum industry should encourage many users who have been concerned about the metal's availability. It should also encourage potential heavy users of metal who cannot risk tooling up for a new raw material of limited supply. On a volume basis, more aluminum is now produced than any other metal except steel.

"On the average, aluminum demand has tended to double every decade. Even this rate has been stepped up in the period since 1939, which saw a five-fold increase in U.S. consumption. There are good reasons to believe the trend will continue.

"Another advantage of aluminum has come about since the beginning of World War II. The large scale use of aluminum during all this time has

# FOR LESS THAN \$500 YOU CAN SOLVE YOUR SMALL PRODUCTION PROBLEMS

WITH THE MODEL G5S

# PRATER PULVERIZER

LUMPY CHEMICALS, SOAP, GLUE and many other materials can be reduced to uniform granulation in this Model G5S Prater Pulverizer! Low in price... compact and sturdy in structure it does an economical, efficient job on low-volume grinding. Built with the same high standards of quality and workmanship as larger Prater models.

5 to 7½ horsepower. Write for details and prices.

PRATER PULVERIZER COMPANY 1517 So. 55th Court, Chicaga 50, III.



PRATER

# WATER

For Process, Boiler Feed & Other Needs



\*The new Penfield Mono-Column Demineralizer pictured above performs all its operating functions completely automatically — even recuts in effluent when proper pre-set purity is reached after automatic regeneration. Write for full information on units of any desired capacity up to 10,000 gph.

COMPLETELY AUTOMATICALLY

Operating on the most efficient deionizing technique known (intimately mixed cation and anion exchangers in a single unit tank), raw water passes through a Penfield Automatic Mono-Column Demineralizer only once — yet comes out with resistance reported as high as 20,000,000 ohms. No heat or steam power is ever required and there are no valves to operate. Even regeneration is accomplished completely automatically by the simple flip of a single switch.

RUBBER-LINED, SARAN-LINED & NICKEL TANKS

Specially fabricated to suit your individual requirements by Penfield's Tank Fabricating and Lining Division. Write today for complete details.

PENFIELD MANUFACTURING CO., INC. 19 High School Ave.

SOFTENERS Penfield "Planned Purity" PAYS!

DEGASIFIERS

given many workers—and many customers—a familiarity with the metal, which would have taken years longer under normal circumstances. This has been a great boon . '.' because people get to know aluminum, it almost sells itself."

# USING ATOMIC ENERGY

# . . . Too . Many . Brakes

"It will take some time to get away from the AEC monopoly. Can we make more rapid progress toward both military objectives and useful atomic power in the meantime? I believe we could.

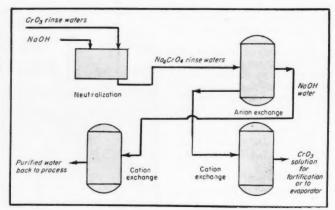
"During the war the first reactors and the bombs were actually produced within about three years. At that time, if there was a major disagreement as to the best route to follow in a development, both routes were followed. In a more recent period, the reverse has been the usual case—when disagreement arose neither route was followed until an exhaustive series of preliminary studies was completed. This might well delay the project a year or more.

"After the successful operation of the Hanford reactors, the additional task to build a power reactor was certainly no more difficult than had been the original warrime assignment. Yet it was over six years later when the reactor at Idaho first produced 100 kw. last December.

"The slowness did not arise from a lack of designs for power reactors which reputable scientists and engineers were willing to build and test. It came rather from an unwillingness of the commission to proceed with any one of these designs until all of the advisers agreed that this was the best design.

"The situation might be likened to an automobile equipped with separate brake levers for each passenger. At every road junction the driver not only had to discuss his preference of route with his riders, but he had to wait until all were convinced, because any one could stop the car.

"We need either to remove some of the extra brakes or to shift riders to men who will reply to the driver 'take the road that you think best and let's move ahead."—Kenneth S. Pitzer, Dean of the College of Chemistry, University of California, Berkelev.



# Ion Exchangers Solve Waste Disposal Problem

Using ion exchange resins, two Illco research men have worked out a successful method for recovering toxic and valuable chromates from rinse waters.

#### A. C. Reents and D. M. Stromquist

During 1950, our laboratories tried to recover chromate ions from resin waters of a chrome plating bath. We proposed a method of using a strong base anion exchanger on the chloride cycle, the chromate anion displacing the chloride ion. The water containing the chloride ion was to be discarded to a drain. When the point of exhaustion was reached, a sodium chloride solution was to be used for regeneration.

Although this method removed most of the chromate ion, it still failed on two important points:

1. The water could not be recycled for rinse purposes.

 The recovered sodium chromate was contaminated with chloride ions, prohibiting re-use in the plating operation.

A. C. REENTS and D. M. STROM-QUIST of the Illinois Water Treatment Co., in a paper delivered before the Seventh Industrial Waste Conference at Purdue University last spring, told of their latest experiments on recovering chrome ions with ion exchange resins. Their paper is the basis of this QED feature. During the early part of 1951, we began work on a method of chromate recovery that would overcome these two difficulties. This proposed method was based upon the assumption that the cold water rinse tanks would be supplied with deionized water.

The rinse waters from chromic acid plating would contain from 10 to 500 ppm. chromates, depending upon the type of plating, shape of the work and the flow rate of the rinse water. For our work, we assumed an average of 100 ppm. chromate content.

The first step in the chromate recovery system consisted of neutralization of the chromic acid with sodium hydroxide. The pH value of this Na<sub>5</sub>CrO<sub>4</sub> water was in the neighborhood of 8.3. After neutralization, the rinse water was passed through the hydroxyl form of Illco A-244. The chromate ion was exchanged for the hydroxyl ion, giving an effluent water containing an equivalent amount of sodium hydroxide. The reaction is as follows:

 $R_4NOH + Na_9CrO_4 \rightarrow R_4NCrO_4 + NaOH$ The ideal system would then in-



Wyandotte Mercury Cell Caustic is used by Visking Corporation in making these Visking casings.

# Wyandotte Mercury Cell Caustic chosen for purity by Visking

The Visking Corporation of Chicago has been an outstanding pioneer in the development of meat casings. Among the products which this firm has helped to pioneer are cellulose sausage casings, casings of regenerated cellulose for large sausages and smoked-meat products, and the casings for popular "skinless" frankfurters.

With this background of serving the meat industry, Visking knows how important purity is. That (as well as uniformity and dependable supply) is why they chose Wyandotte Mercury Cell Caustic, the naturally pure caustic.

#### Careful Shipment

This reagent-pure caustic . . . one of many grades . . . meets the strictest of industrial specifications. It is shipped in specially insulated tank cars with an "M.A.-4" caustic-proof lining which prevents iron pickup . . . assures purity on arrival.

If you wish to test the purity and other characteristics of this or any caustic, write us for our free booklet on analytical procedures for caustic, soda ash and bicarbonate of soda. And for help in specifying the right grade for your processes, get in touch with your nearest Wyandotte district office. Wyandotte Chemicals Corporation, Wyandotte, Mich. Offices in Principal Cities.



# SAVING EFFICIENCY

- Longer Life
- Custom Molded Precision Pipe Fit
- Attractive, Smooth Finish

Now available in pipe covering and block insulation, Mundet 85% Magnesia permits new heat-saving efficiency. Precision manufacturing on the latest type of automatic equipment insures uniform standards. Extra durability is built into the insulation. It does not "powder", settle or disintegrate. It is unaffected by either steam or water leakage. It maintains an attractive, smooth finish. Precision pipe fit is assured, with no spaces left for

the escape of heat. You benefit from the most modern manufacturing facilities for the production of heat insulation. Write for specification information and recommendations. Mundet Cork Corporation, Insulation Division, 7101 Tonnelle Avenue, North Bergen, N. J.



# -MUNDET

WIRE MESH

Maybe it all *does* look pretty much the same at first glance. But when a firm has been making wire mesh

for 70 years man and boy, there's bound to be a little more to it than meets the eye—a little more know-how in engineering and weaving, a little more quality in the product, a little more service and satisfaction for the user.

JELLIFF WIRE MESH is woven in all ductile metals

JELLIFF WIRE MESH is woven in all commercial weaves

JELLIFF WIRE MESH is woven in widths up to 72 inches

JELLIFF WIRE MESH is economical. Every foot runs true to the specifications.



JELLIFF WIRE MESH is a quality product and has been for 70 years. You can depend on it.

Write today for full details about JELLIFF WIRE MESH, JELLIFF WIRE MESH PRODUCTS, and JELLIFF'S CONSULTATION SERVICE on wire-mesh engineering. Address Department 15.



QED, cont. . .

clude passage of this sodium hydroxide (100 ppm.) back to the rinse tank for re-use.

This system is successful when rinsing the normal copper-nickel-chrome plate, but the high pH of this rinse water is deleterious to anodized aluminum and magnesium parts. However, the rinse water containing the sodium hydroxide is not recommended for use with the wartime enameled plated work. To provide deionized rinse water for these operations, a hydrogen exchanger for removal of the sodium hydroxide was used.

After exhaustion of the anion exchanger, the chromate ion is recovered as Na<sub>2</sub>CrO<sub>4</sub> in a solution of sodium hydroxide. A 15 percent NaOH solution is used as the regenerant for the strong base anion exchanger.

Anion exchange occurs in a neutral or alkaline media. This is necessary because chromic acid is a strong oxidizing agent. If agent anion exchange could be carried out on chromic acid solutions, the problem would be quite simple.

Earlier grief with weak base anion exchangers contacted with chromic acid indicated that capacity loss would be quite rapid. However, some of our first work was done on this method using the strong base anion exchanger, Illco A-244 on the hydroxyl cycle.

TRIAL NO. 1

For the experimental work on the proposed method, a sample of Illco A-244, 0.02 cu. ft. was used. This resin was placed in a 1 % in. diameter by 48 in. glass tube provided with a graded quartz support bed. The resin bed depth was 26 in. Regeneration was carried out with a 15 percent NaOH solution, 40 min. contact time. The NaOH dosage was 5 lb. per cu. ft. Soft water was used for regeneration.

The exhausting solution was prepared by adding technical grade chromic acid to 120 gal. of deionized water from a mixed bed unit, and neutralizing with NaOH to a pH of 8.3.

This solution was allowed to flow by gravity through the resin bed at rates of 5 to 7 gal. per sq. ft. per min. A total of six cycles was made using this method of operation.

Average sodium chromate concentration of the effluent, neglecting the low concentrations was about 3 percent. It is evident that these tailings still contain too much chromate to be dumped into the sewer. As the sodium chromate concentration dropped, the sodium hydroxide concentration was still relatively high. This portion of the regenerant solution could be used as reclaim alkali for the next regeneration, or better still, for neutralization of the incoming chromic acid.

The regenerant effluents from cycles 1 through 5 were collected and passed through Illeo C-211 regenerated with 12 lb. H<sub>s</sub>SO<sub>4</sub> per cu. ft., 10 percent solution. The NaOH was converted to water, and the sodium chromate to chromic acid. A 2 percent solution of chromic acid was obtained.

In order to re-use the water for rinsing, the NaOH would have to be removed for some operations. A tube containing 0.036 cu. ft. Illco C-321 on the hydrogen cycle was used in the reverse deionization set-up. The water produced by this reverse deionization is suitable for re-use in the rinsing operation.

TRIAL NO. 2

An automatic cycler was utilized to determine useful life of Illco A-244 when operating on a solution of sodium chromate. A 1½ in. tube was filled to a depth of 19½ in. with Illco A-244. The following solutions flowed by gravity to the resin column:

1. Sodium hydroxide—10 percent, used for regeneration (300 cc).

Deionized water—use for backwash, sweetening off and rinse.

3. Sodium chromate solution— 1,000 ppm. in deionized water.

 Sodium chloride solution—1,000 ppm. as CaCO<sub>9</sub>, used for periodic capacity checks.

A cycle was completed every two hours. A total of 205 cycles was run. No darkening or other physical evidence of resin deterioration occurred during these tests.

Periodic capacity checks were made by passing a solution of sodium chloride (1,000 ppm. CaCO<sub>3</sub>) through the hydroxyl form of the resin at a rate of 5 gpm. per sq. ft. The liberated NaOH was titrated. When the NaOH content of the effluent dropped 20 percent from maximum, the resin was considered to be exhausted.

The resin performed satisfactorily after the 205 cycles of operation on sodium chromate solution, showing no effects of oxidation. (Continued)





**Descriptive Bulletins on Request** 

LEE METAL PRODUCTS CO. INC.

417 PINE STREET . . . PHILIPSBURG, PA.
ALL LEE KETTLES ARE MADE TO A.S.M.E. CODE

# For More Than Wears...



• • • La Favorite Rubber Engineering has saved industry Millions of Dollars by inhibiting corrosion of process equipment through rubber lining and/or covering of pipe, tanks and hundreds of variations in process equipment.

The La Favorite method, developed over the years, has consistently proved its merit as a primary source of corrosion protection. Inspection of equipment in use for many years after lining and/or covering has disclosed that the La Favorite method of application and compounding of the rubber stock have always been equal to the life of the rubber.



This large sea-going condenser was completely lined, including



One of several all-rubber expansion joints for the power plant of a public utility.

For details on lining or covering of processing lines and equipment, send blue prints for estimate of cost, or write for bulletins on your type of equipment.

LA FAVORITE RUBBER MFG. CO.

269 Wagaraw Road

RUBBER COVERING

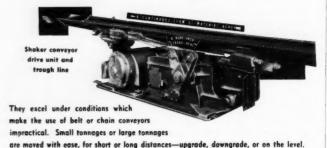
HOWMOTHS, N. J.



# **NEW! GOODMAN SHAKER CONVEYORS**

offer a practical and economical method of moving hot and abrasive materials.

Whatever you want to move—coke, sinter, steel scrap, castings, silicon carbide, mill scale, dolomite, bauxite, or other hot, abrasive material—it will pay you to investigate Goodman's specially designed shaker conveyors.



Every Goodman Shaker Conveyor installation is engineered to suit its specific application.

# GOODMAN MANUFACTURING COMPANY

Industrial Manufacturing Division Halsted Street at 48th

Chicago 9, Illinois

QED, cont. . .

# HANDLING MATERIALS

# ... Why Pallets Go Wrong

"From the results of survey, and from personal interviews, we've found that one construction feature accounts for most of the pallet failures . . . Fasteners cause about 80 percent of all pallet troubles," reports Modern Materials Handling (May 1952, p. 52).

What's Wrong: 1. Nails pull out and snag bagged or packaged products stored on the pallet.

Stringers split because nails are driven too near the edge or because the nails weren't staggered when the pallet was built.

3. Fasteners rust, the lumber gets old and brittle, and fasteners pull away.

4. Deck boards split because of improper nailing.

5. Rough handling acts first on the joints of the pallets because they are usually the weakest spots.

6. Nails protrude and injure per-

Nails or other fasteners lift because the forks of industrial trucks put too great a strain on the first deck board.

What's Right: "Pallet manufacturers have tried them all-screws, bolts, nails, spiral nails, etc. They have had varying degrees of success. One of the best pallets has a clinched nail construction that is making records for low maintenance.

"Probably as important as the fastener itself is the method of driving it. Fasteners should be counter-sunk, and they should be driven into predrilled holes. This one construction feature alone will make a decided cut in the cost of pallet maintenance."

# TESTING FOR CHEMICALS

# . . . Conventional Ones Fail

The Bureau of Mines dewpoint test is considered the standard method for determining water vapor in natural

However, it has its drawbacks. It won't work on a gas whose dewpoint is not lower than the temperature at which other component vapors condense. It cannot give accurate results on a gas that contains vapors of glycols or glycol amines.

At the recent Production and Chemical Conference of the American



American industry is continually searching for new ways to stop waste and increase production and efficiency. A good example of this is the Koppers-Elex electrostatic precipitator. Shown below are a few typical ways industry uses them to combat waste . . .



BLAST FURNACE GAS must be cleaned before it can be used as a fuel. Koppers-Elex electrostatic precipitators clean this gas to residuals as low as .002 grain per cubic foot.



FLUE GASES from recovery boilers in pulp mills contain valuable materials. Koppers-Elex electrostatic precipitators recover several hundred thousand dollars worth of these materials yearly.



FLY ASH from power plants and factories may drop a blanket of dust extending three to five miles. Koppers-Elex electrostatic precipitators stop this nuisance and preserve public good will.

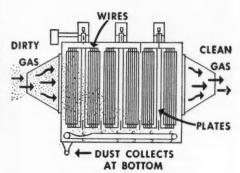
Gueranteed: All Koppers-Elex electrostatic precipitators are guaranteed to equal or better (under tests made by your own personnel) any efficiency or residual content you specify.

# ENGINEERS! You should know about these six design features of Koppers-Elex electrostatic precipitators!

KOPPERS has made sweeping improvements in electrostatic precipitator design! For example, double chambers eliminate expensive by-pass systems and the resultant loss of materials during inspection or maintenance. And re-entrainment is sharply reduced because rapping is sectionalized.

Successive collection zones are separately energized to provide maximum voltage for highest collection. And because each field is, in effect, a separate precipitator, the outage of one field does not stop gas-cleaning action. In addition, completely enclosed and compact "package" mechanical or vacuum tube power packs simplify installation and operation.

Another exclusive Koppers feature is the drag scraper which provides continuous dust removal, eliminates plugged hoppers and prevents bothersome dust build-up. For detailed information on recovery, gas-cleaning or nuisance abatement results write today to: Koppers Company, Inc., Precipitator Dept., 219 Scott Street, Baltimore 3, Md.



If you have a gas-cleaning problem, write today to: Koppers Company, Inc., Precipitator Dept., 219 Scott St., Baltimore 3, Md.



Koppers-Elex PRECIPITATORS



It pays to specify packing that has been produced by packing specialists. A score of men, like Dan, have been with the Durametallic Corporation for periods of 10 - 20 and 25 years. Convincing evidence why Durametallic Flexible Metallic Packings are performing the most dependable sealing jobs in industry.

DURAMETALLIC



CORPORATION

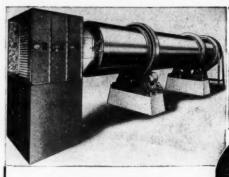
Continuous Press

DAVENPORT

De-watering Press-

ROTARY

es and Screens.



# DAVENPORT ROTARY HOT AIR DRYER

For materials or products that are critical to high temperatures, solve your drying problem with a Davenport Rotary Warm Air dryer. Write for our complete catalog. For quick reference see "Sweet's 1952 Processing Industries" or "Chemical Engineering Catalog, 1953".

DAVENPORT MACHINE AND FOUNDRY COMPANY
Davenport 7 Iowa U. S. A.

Steam Tube, Hot Air and Direct Fire Dryers. Water Tube and

Air Coolers.

QED, cont. . .

Gas Association in New York, Researcher Willard F. Brickell of United Gas Corp. told of a new and better procedure, which will work where others fail.

A direct chemical method, the new procedure gives accuracies of plus or minus 1.2 lb. of water per million cubic feet of gas—at both low and high pressures. In this method, ethylene glycol absorbs all water vapor in the gas, and is then titrated with Karl Fisher reagent.

## DISPOSING WASTES

## . . . In Ammonia Soda Process

What to do with wastes from the ammonia-soda process?

In attempts to solve the problem, engineers for many years have clarified the waste liquor (unconverted sodium chloride and calcium chloride) by settling in large ponds or waste lakes and then discharging into a nearby stream. Of course today many states are opposed to such methods of disposal.

Recently an advisory committee of Chemical Salts Industry representatives working with the Ohio River Valley Water Sanitation Commission studied alternate ways to dispose of these wastes. To date this ORSANCO Committee has considered two methods.

Sub-Surface Injection—In recent years, waste disposal men have become interested in sub-surface injection, a method that has been used successfully by petroleum engineers in disposing of aqueous brines separated from crude oil.

Although the method has worked well for the petroleum industry, soda men doubt it will work as well for them, at least in the Ohio River Valley Area. Petroleum brines are returned to the same strata that produced them, and troubles seldom occur. But a soda plant would send brines into a foreign underground stratum, and trouble is possible. Soda engineers must consider the geology of their locations, as well as the past, present and probable future use of any underground resources that might be affected.

There are other drawbacks. Injected wastes might eventually find their way to fresh water supplies; or the corrosion and failure of disposal well tubing, or the leakage of old wells, might cause almost immediate pollution of fresh water bearing strata.

If the fresh water formations were polluted by this method, the volume of water that would have to be pumped out to relieve the contamination might approach or exceed that of the waste injected. Legal liabilities could be considerable.

"Although the disposal of very small volumes is now being effected by one plant in the Ohio Valley area, our conclusion is that the injection of millions of gallons of waste per day in now known strata has no practicable possibilities," said Diamond Alkali's U. T. Green at the recent Purdue Industrial Waste Treatment Conference.

Waste Evaporation—The Chemical Salts Industry Committee cooperating with ORSANCO is also considering the evaporation of waste liquors to produce a marketable grade of calcium chloride. Byproduct calcium chloride is in fact produced and marketed today by two ammonia-soda manufacturers in this country.

If adopted, soda plants would boost total calcium chloride production about 10 times present output. A new market obviously would have to be created. Unfortunately, no extensive new uses for calcium chloride are developing. Apparently the byproduct is completely out of step with the primary product, and there appears to be no final answer to the problem.

# ABATING FOUL AIR

# ... Advice on Tunnels

Aeronautical wind tunnels can often be adapted to investigate gas dispersal problems. Nevertheless, they have always lacked something or other. For example:

 The short test section limits the length of observable downwind region.

Windows in the test section are usually too small for photographic requirements.

3. Minimum operating speeds are frequently higher than those convenient for stack gas dispersal experiments.

4. Complex-force measuring equipment and high power requirements, two costly features of modern aircraft tunnels, are not needed.

Recently, air pollution abatement work took a large stride forward when engineers at New York University built a wind tunnel designed for the study of gas dispersal processes exclu-

# PROBLEM:

To provide a drying system that would increase the output of titanium dioxide without sacrifice in the quality of the finished product.

# SOLUTION:

Proctor engineers recommended a Proctor continuous conveyor drying system with a rolling extruder feed. Preforming permits air to circulate all the way through the bed of material on the constantly moving conveyor. Production has been materially increased. All other factors affecting drying are carefully regulated for accurate control of product quality.

# Another processing problem solved by

# PROCTOR INTEGRATED ENGINEERING

This processing problem was solved only by painstaking research. Exhaustive test work done in the Proctor laboratory, in cooperation with the customer's technicians, netted conclusive results that were projected into full scale operation. So accurate was this work that the performance of the drying system was guaranteed in the sales contract and the dryer was designed to dovetail right into the complete processing line. This approach to a processing problem is INTEGRATED ENGINEERING AT WORK!

# By INTEGRATED ENGINEERING we mean simply this —

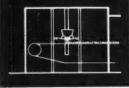
- 1. Sales engineers are available for consultation.
- A completely equipped experimental laboratory is available for test work at no cost or obligation.
- Engineering background and experience in drying equipment and its relation to associated processing equipment in the range.
- Close cooperation between Proctor engineers and the customer's technicians to bring about the solution to processing problems.

# NOW PROCTOR IS PREPARED TO ENGINEER AND MANUFACTURE RELATED EQUIPMENT

With their long background in designing and building precision drying machinery, Proctor engineers have acquired a wide knowledge of processing equipment requirements... so that today Proctor & Schwartz actually offers a complete engineering-manufacturing facility ready to help you consider not only your drying equipment needs—but a complete range of related processing equipment.

What is your processing machinery problem? Let Proctor INTEGRATED ENGI-NEERING help speed your solution.









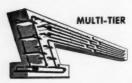






# CONTINUOUS PRODUCTION EQUIPMENT

for Bakery, Confectionery, Food, Chemical and Allied Industries



Greer engineers are prepared to work with you on plant layout and to design special applications of the Greer Multi-Tier Conveyor for your particular product. Our wide experience with installations of this machine in many different industries can

be invaluable in helping to convert from batch methods to continuous processing or to further simplify and streamline your present production processes. The Multi-Tier is the real answer to compact production and space-saving economy.

#### COOLING TUNNEL

As an alternate to the Multi-Tier where shorter production periods are required, the Greer Cooling Tunnel offers the most efficient answer where controlled temperatures and air circulation are a factor.

Thirty years of developing and building such equipment makes these units available in widths ranging from 16' to 52' and lengths variable by 8'. The special sectional steel belt offers a feature which provides the most efficient cooling obtainable.

GREER J. W. GREER COMPANY

119 WINDSOR STREET, CAMBRIDGE 39, MASS.



QED, cont. . .

sively. With the new tunnel air pollution men can now simulate meterological conditions, besides reproducing wind speed and direction. Actually in preliminary experiments, they have already reproduced vertical temperature variations in the tunnel air stream.

At the Air Pollution Abatement Conference sponsored by the Manufacturing Chemists' Association and held earlier this year, Gordon H. Strom of New York University, who helped build and operate the new tunnel, passed on several observations to fellow engineers who intend to work with air-pollution wind tunnels.

1. Smoke produced by vaporization of heavy oil and condensation into fine droplets has been used with considerable success. Various chemical smokes such as ammonium chloride have been tried, but with little success. Chemical smokes cause considerable corrosion in both the carrying pipes and the stacks. While the equipment for the oil fog smoke is more complex, the advantages justify its use, especially for long tests.

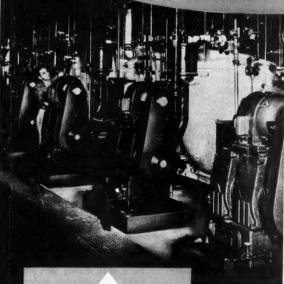
2. Small amounts of hydrogen sulphide in the smoke plume have been used to show up fouled areas. When painted with a lead acetate solution, the contaminated areas turn dark on contact with the plume. By applying lead acetate to grid strings stretched across the air stream, you can obtain plume cross sections.

3. Stack gas momentum carries plume upward and airstream momentum moves the plume horizontally. The forces between the plume and airstream result from changes in momentum. From momentum characteristics you can deduce your scale factor, which helps give a true representation in miniature of full scale phenomena.

4. Reynolds numbers contain the product of air speed and length. Therefore, to obtain correct Reynolds numbers in the wind tunnel, wind speed must be increased as the model size is reduced. However, the correct wind speed may at times become absurdly high. Fortunately, Reynolds numbers for the miniature need not be kept at full scale value. As a matter of fact, Reynolds numbers, except at very low speeds where the fluid inertia forces become small, has little influence on flow.

5. To find minimum wind speed,

# Stokes Microvac Pumps...are basic to Vacuum Processing



Typical installation of Stehes Vecuum Pumps.

Send for new Vacuum Calculator for rapid alide-rule calculations. Includes standard ABCD log scale. Also send for Catalog 700. "Stokes Microvac Pumps for High Vacuum" with copious reference material.



High volumetric and mechanical efficiency make these famous pumps economical and reliable units in any vacuum system.

Capacities of Stokes Microvac Pumps run from 15 to 500 cfm... pressures to 10 microns absolute. Power consumption is low and the top-mounted motor contributes to compact design requiring minimum floor space.

Lubrication of the four moving parts (including the exhaust valve of corrosion-resistant Teflon) is fully automatic.

There are no stuffing-boxes or grease-fittings, and no packing.

Parts are precision-finished, standard and interchangeable. Freedom from wear assures years of trouble-proof service.

Stokes is the only manufacturer of equipment for complete vacuum systems, including Microvac mechanical pumps, oil diffusion pumps, McLeod Gages and Vacuum Valves.

Consult with Stokes on the application of vacuum to drying, freeze-drying, impregnating, extraction, solvent recovery, evaporating, vacuum metallizing, and to other purposes for which vacuum deserves exploration.

STOKES

STOKES MAKES

Plastics Molding Presses,

Industrial Tabletting

nd Douder Matel Dress

Pharmaceutical Equipment,

Vacuum Processing Equipment

High Vacuum Pumps and Gages,

Special Machinery

F. J. STOKES MACHINE COMPANY, 5520 TABOR ROAD, PHILADELPHIA 20, PA.

observe the shape of the plume at various speeds for a fixed ratio of stack gas to wind speed. Experiments on building models about 0.5 ft. high showed no appreciable changes in flow pattern at wind speeds above 5 ft. per sec.

6. In the study of hot plumes, remember: (1) momentum characteristics and building turbulence primarily determine the initial plume shape for high gas ejection speeds and moderate buoyancy effects; (2) Froude number, the scale factor employed in hydrodynamic tests of ship models, applies to heated gas plumes; (3) to get the scale factor, determine ratio of speed squared to length of

"We at New York University are convinced that the techniques and methods suggested . . . offer relatively inexpensive means for studying pollution problems associated with stack gas emission and building configuration," said Strom.

# OBSERVING TRENDS

# . . . In Vinyl Plasticizers

What trends are developing in the field of vinyl plasticizers? According to Richard G. Kadesch of Emery Industries, who writes in the August issue of Modern Plastics, the vinvl plasticizer industry can expect:

1. Increase demand for non-toxic plasticizers in food packaging.

2. More requirements, particularly from the military, for flame resistant and low temperature-flexibility materials.

3. Greater stress put on rigid and semi-rigid uses.

4. Plastisols becoming even more popular.

5. Plasticizer and finished product standards going up.

6. Single all-purpose plasticizers seeing less service. Blends for specialized use, in which each component contributes something, will take over.

7. More extensive use of permanent, non-migrating plasticizers of lower viscosity.

8. Greater variety of alcohols and acids available for plasticizer manu-

9. More competition for esters from non-plasticizer uses such as smokeless powder, oils and greases.

# How to Bring Up Foremen

- 1. Pay your foremen substantially more than their men.
- 2. Select your foremen properly and train them well.
- 3. Make a foreman really a part of the management group.

According to the American Management Association, many rank-andfile workers will not take jobs as foremen. A while back, McGraw-Hill heard of the situation, and had its Department of Economics run a survey to find out why. Questionnaires were sent to 50 major companies who employ about 2 million people and the replies recorded and tabulated.

Helped by these statistics, Harry L. Waddell, editor of Factory Management & Maintenance, told the recent Personnel Conference of the AMA how to successfully manage those workers who may want to be foremen. His paper is the basis of this QED feature.—Editor.

Principle No. 1-Pay your foremen substantially more than the men in the ranks.

Companies whose men are ambitious to become foremen keep foremen's salaries well ahead of wages of men under them. Some leading companies maintain differentials up to 30 and 35 percent.

Basic wage rates are not enough. Often the overtime paid to rank-andfile workers makes the foreman's job less attractive-especially when the foremen get no overtime pay. To maintain a healthful differential, some companies pay overtime to foremen; some include foremen in management incentive-bonus programs; and some pay bonus money monthly, even though it is figured quarterly.

Principle No. 2-Select your foremen properly and train them well.

Surveys show that most prospective foremen have two fears: (1) losing his seniority, (2) falling down on their

1. Many companies have union contracts that read something like this: A rank-and-file worker who takes a promotion to foreman-and thus leaves the bargaining unit-loses his seniority.

Often he can return to the ranks within six months and not lose his seniority. But after that, he goes to the bottom of the list, or near it. So if he doesn't make the grade as a foreman (and he'd hardly know within six month), he has lost his seniority protection.

2. No doubt the job of a foreman is getting harder, because today more is expected of the foreman. Only about 15 or 20 years ago, a foreman used his technical know-how derived from experience to supervise the mechanical processes in his department. Now, management expects him to be a real leader of his men-anticipating and heading off grievances, and dealing with them if they arise.

He has a bothersome set of government regulations on wages and hours to understand and live under. He is often dealing with better educated, more articulate workers-which makes his supervisory job different, and in some ways more difficult. Most important, management expects him to be more skillful in handling people -because today it is good business to have high morale in the work force.

By proper selection of your prospective foreman and good training you can remove, or at least mitigate both

these problems.

What's the best methods for selecting men for promotion? Not all good methods are formal programs, but all of them refer to these standards:

1. Today, a foreman has to lead people; therefore, he must be adept at

human relations

2. A good foreman is willing to assume responsibility. If you don't have time to investigate your prospective foreman, watch for the workers who get ahead in their union.

3. You should be sure your criteria for selection are in tune with today's demands on the foreman. Once upon a time these criteria boiled down pretty much to technical skill in the department's jobs. Maybe they included length of service, so-called loyalty to the company, and even physical size befitting a boss. These qualities are still important. But aptitude for leadership and ability to teach are more important today.

As to training, a well-thought out—though perhaps informal—training program does two things:

1. Prepares a man to become a foreman before the job is finally offered to him, and

Continues his training after promotion so that he can handle the demands of his job with skill and assurance.

A successful training program encourages prospective foremen. If your existing foremen are really good-because they were selected well and are kept well trained—then the men under them are more likely to be ambitious than if the men in those jobs were obviously inadequate. Well trained foremen, reports show, are likely to feel secure—which is, in the long run, a firmer foundation for security than union rules on seniority.

Principle No. 3—Make foremen really a part of the management group. Progressive executives believe such action is essential. Foremen should feel that they belong in management, that they are full-fledged members of the team running the show; that they are on the inside of management deliberations and decisions.

But, they warn, words alone will never make a foreman feel he belongs. You must act. A foreman will feel he is part of the team when he is actually part of the team. Really take your foremen into your management group, and let him help shape your policies and decisions.

# FINDING PRESSURE-DROP . . . Across Bubble Plates

What are the characteristics of pressure-drop in a bubble-plate distillation column? Actually, Rogers & Thiele have advanced a theory, and the results of their work, published in 1934, give adequate agreement with experimental data.

But correlators in recent years have been far from satisfied. "It may be readily shown that these results can lead to gross inaccuracy when extrapolated to slot openings above 2 in., and the correlation does not hold for openings smaller than those Rogers & Thiele have called 'the minimum flow point,'" say C. A. Cross and H. Ryder. The two have since run experi-

# BREAKAGE

# STANDARD CONVEYORS CAN AID YOU TO REDUCE IT

Put conveyors to work moving cases, cartons, packages, parts, units through manufacturing or processing to storage or shipping. Speed handling operations — reduce breakage — increase safety — save manpower, time, and costs.

An experience record of more than 45 years, serving all classes of industry and business, qualifies Standard to be of expert service to you on any "package" conveyor need roller, belt, slat, chain, push-bar, sectional, portable self-contained units — spiral chutes — pneumatic tube systems. Write—Address Dpt.CM92.

STANDARD CONVEYOR COMPANY

General Offices: North St. Paul, Minnesota Sales and Service in Principal Cities



# Whiton 1922 Wertical Turbines

Economical—Dependable ... for PUMPS • FANS • COMPRESSORS

Featuring: -

 SOLID STEEL ROTOR . . . gives high efficiency for low-speed, direct drive.

 LABYRINTH SHAFT SEAL . . . positively prevents leakage. Eliminates wear and seizing.

Available in various types and frame sizes up to 600 Horsepower.

For full information on how Whiton Turbines can fill your requirements, write directly to our Turbine Division.

SPECIALISTS IN HORIZONTAL AND VERTICAL TURBINES.

WHITON MACHINE CO.



Get the most out of your Spraying Equipment with minimum power ... with efficient spraying.

Use Yarway Nozzles. No internal vanes or other restrictions to clog or hinder flow. Two types—Yarway Involute-type producing a fine hollow spray with minimum energy loss, and Yarway Fan-type producing a flat fan-shaped spray with time-saving slicing action for cleaning.

Wide range of standard sizes and capacities. Cast or machined from solid bar stock.

Thousands in use. Write for Bulletin N-616.

# YARWAY SPRAY NOZZLES





BALL BEARINGS position rotors axially for less wear on bearings and timing gears INTERCHANGEABLE ROTOR SCREWS make major overhauls simple, inexpensive—greatly reduce need (and expense) of periodic pump replacement



Describes Complete Line of NEW SCREW PUMPS!

Write for "Screw Pump Reply Sheet". Shows uses, capacities, advantages—reverse side can be filled out for prompt quotation. Sier-Bath GEAR and PUMP CO., Inc.

9259 Hudson Boulevard, North Bergen, N. J.

Also Manufacturers of "Gearex" Pumps, Precision
Gears and Flexible Gear Couplings

QED, cont. . .

ments to eliminate these uncertain-

New Theory—This past winter, in in the February issue of the Journal of Applied Chemistry, Cross and Ryder announced a new theory for pressure drop across bubble plates. Basically, their theory is a modification of the hydrodynamic or Rogers & Thiele theory. All their measurements, secured during recent experiments, fit with the hydrodynamic theory when it is modified to account for the effects of surface tension.

Surface tension effects explain the deviation from the power law. "Essentially the slot-opening at which the deviation takes place may be thought of as equivalent to the maximum bubble pressure which the particular slot will sustain. Thus as the flow rate is reduced the slot-opening falls in accordance with the simple power law until this critical value is reached. Further reduction of gas velocity does not appreciably reduce the slot-opening, but at a point which is closely reproducible for any particular experimental arrangement bubble formation becomes intermittent," say Cross &

Below this velocity, short bursts of bubbles crowd through the slot at regular intervals. Each burst goes off when the level behind the slot has fallen to the critical value. The bursting halts when the level behind the slot is raised by the loss of gas. "In this region the frequency of the bursts increases linearly with increasing gas velocity, until the individual bursts merge together at the transition to continuous bubbling," they say.

Using the new theory, designers would determine slot opening by surface tension alone for air rates below critical. However, above the critical rate the original hydrodynamic equations would still apply.

Better Correlation—As a result of Cross and Ryder's work, constants in the original hydrodynamic equations have higher values. For example, the discharge coefficient C for design calculation is now 0.57. In the Rogers & Thicle experiments, it was 0.51. (The larger values obtained in the earlier work were probably due to the inclusion of measurements below the critical rate.) In particular the exponent of h (the slot opening) now corresponds with the theoretical values within the limits of accuracy.



# WELDING FITTINGS ON YOUR MIND

It will pay you to think of Midwest whenever you think of welding fittings. For example: the variety of elbows offered only by Midwest provides greater latitude in piping design and permits improvements and economies not otherwise possible.

# MIDWEST



Same radius as ASA but tangen equal to 25% of nominal pipe size on each end. Saves pipe, layout an worlding time. Costs no more that ASA Sizes to 24"

# SHORT



Recommended where space limits tions do not permit use of "Long Tangent" or ASA Elbows. Size

#### ASA STANDARD



Dimensions conform to applicable size range of American Standard to Butt-Welding Fittings, ASA B16.1 Tolerances much less than allow able. Sizes to 26°.

# MIDWEST



Takes the place of a straight size elbow and a reducer. Eliminates one weld, reduces pressure drop, easier to insulate. Sizes to 12", reductions to half size.

4580

MIDWEST
PIPING & SUPPLY CO., Inc.

Main Office: 1450 South Second Street, St. Louis 4, Mo.
Plants: St. Louis, Passici, Los Angeles and Boston
Sales Offices: Now York 7–30 Church St. e Chicago 3–779 West Monroe St.
Los Angeles 33–250 Anderson St. e Houston 2—1213 Capital Ave.
Tules 3—224 Whigh Bildg. e Boston 27—426 First St.

# Need Help on Your Filtration Problems?

# SHRIVER FILTER PRESSES

are your best bet for operating versatility and economy. They recover solids—clarify liquids — wash, extract, dry, redissolve or melt the filter cake — thicken slurries. You can get any combination of these functions for any pressure or temperature.

# WHAT DO YOU NEED?

A filter that must handle thousands of gallons an hour or a portable unit for lab. or small-scale use on several products? In a Shriver Filter you can arrange for any desired flow rate and cake capacity, with construction to resist corrosion or abrasion and to prevent contamination or leakage.

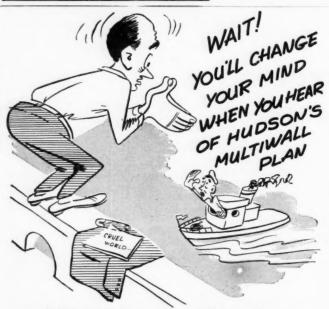


Shriver side feed, closed discharge, washing type filter press with "Hydro-Klaser" quick closing mechanism.

For dependable, economical filtration, we repeat, "Your best bet is a Shriver Filter Press." Catalog 52 proves it. Write for a free copy.

# T. SHRIVER & COMPANY, Inc.

802 Hamilton St. Harrison, N. J.



You'll jump too—but for jay—when you get the big news from Hudson (manufacturers of multiwall sacks with assured delivery)!

# HUDSON PULP & PAPER CORPORATION Dept. 131, 505 Park Avenue, New York 22, N. Y.

QED, cont. . .

### **CUTTING COSTS**

# ... The Hard Way

For the pulp and paper industry, the current agitation against stream pollution may be a blessing in disguise. It has forced the industry into a lively investigation of the use and recovery of soluble bases, notably, those of magnesium, sodium and ammonia.

"While all the problems have not been solved on chemical recovery, remarkable progress has been made which, in the end, could reduce sulphite pulp costs . . . as much as \$5 a ton," says Consultant Vance P. Edwardes, who spoke at a recent meeting of the Technical Association of the Pulp and Paper Industry in Syracuse, N. Y.

## PLANNING AHEAD

# ... For How Long?

Defense mobilizers—at least those who gaze in our manpower pool—have to make plans far in advance. This spring, Arthur S. Fleming, president of Ohio Wesleyan University and assistant to the Director of Defense Mobilization warned that defense manpower plans are based on an emergency that may last a good many years.

"We are now in a period of universal military service," Fleming said. "And we will continue to be as long as we have to maintain a force of 3,700,000. We have to assume that we are in defense planning and mobilization emergency, which will be with us for at least 15 years."

## PLANNING AHEAD

# . . . Effects of Atomic Power

"Atomic energy in the U. S. is already big business. Since the production of the first self-sustaining chain reaction in 1942, there have been over nine years of large-scale development. During this period the U. S. Government has spent more than \$6.5 billion in plant, operations, development and research.

"The properties of the Atomic Energy Commission already represent a capital investment of \$3 billion, which is greater than that of General Motors Corp. or the Pennsylvania Railroad. In the fiscal year 1952, appropriations of \$1.7 billion were made by Congress for further additions to plant, continuing operations and development.

"Engaged in full-time atomic energy work are 120,000 people, and approximately 5 percent of the total engineering and research population of the U. S.

"The development of nuclear power plants may not mean a golden age of free power, but in a generation there will be a major relocation and redistribution of both industries and people. The effect on the world outside the U. S. is apt to be far greater than on our own comparatively power-rich country."—Karl Cohen, Executive Vice President, Walter Kidde Nuclear Laboratories, Inc.

## MAKING MONEY

# . . . June Graduates

"A couple of hours before the commencement exercises at Columbia last Thursday, we had an illuminating chat up there with an amiable, composed young man of twenty-four who was about to be awarded a Bachelor of Science degree in Engineering and then cast loose into what college graduates used to think of as a harsh, cold, unaccommodating world."

The young engineer, referred to pseudonymously as David Murrav by The New Yorker in its June 14th issue had just accepted a job. On June 16th, he was going to work, at a salary of \$368 a month, for Du Pont at the big hydrogen bomb plant at Aiken, S. C., that Du Pont is building for the government.

Before accepting Du Pont's offer, Murray turned down 15 other corporations. The personnel men he disappointed—ten made him definite offers, five tentative—were from Colgate-Palmolive-Peet, United States Steel, Westinghouse, the Hughes Tool Co., Otis Elevator, Chase Brass & Copper, Continental Can, Eastman Kodak, Union Carbide & Carbon, the Electro Metallurgical Co., the Brown Instrument Co., Procter & Gamble, Ford and two divisions of General Electric.

Many of these companies sent men to the Columbia campus to talk to engineers who were getting degrees. Some conducted interviews as early as last fall. "The competition among these big corporations for people with





# High Efficiency

# Long Service Life

# Low Maintenance Costs

You are assured of high efficiency in heating or cooling - long service life - low maintenance and service costs, when you specify Aerofin extended-surface heat exchangers.

The reason is obvious: Aerofin makes heat exchangers exclusively—offers you the results of unequalled experience, unequalled production facilities, unequalled materials testing and design research—and the guidance of a complete, highly skilled engineering staff, at the plant and in the field.

For the most practical solution to your heatexchange problem, ASK THE AEROFIN MAN.



Aerofin is sold only by manufacturers of nationally advertised fan system apparatus. List on request.

QED, cont. . .

technical training, like me, has been fantastic, no matter where you stand academically," Murray said. "Scholastically, I guess I rank just about in the middle of our group. I have a B-plus average."

During one series of interviews, Murray spent part of his Christmas vacation at a Procter & Gamble plant in Missouri. "Very nice people there. They offered me \$350 a month, but there were some features I didn't care for. It was a defense-production job—the kind that might run four years, until this war thing cases up, and then I'd be stuck. Of course, they did say that in that event they'd probably find something for me elsewhere in the organization, but I don't particularly like 'probably's."

Companies offered Murray from \$304 (G.E. Manufacturing Services Division) to \$425 (Hughes Tool Co.). "Ford offered me a job at \$360, by telephone. U. S. Steel bid \$325 about the time I gave the nod to Du Pont.

"I visited the Du Pont people in Wilmington in March. They struck me as extremely efficient—they and Proctor & Gamble. Du Pont knew what they wanted, and they have an automatic review of your salary every six months. How you make out there depends on what you do, rather than luck. I'm afraid of getting along in a giant organization. I investigated all these places pretty thoroughly before I made up my mind. First, I weeded out the undesirables, and then the just fairs. When I wrote all the others saving I couldn't come in with them. I made a point of not insulting them. You never know, after all, when you may be looking for a job.

"Oh, incidentally, I did visit one factory—Johnson & Johnson—where I didn't get a definite offer. They just said they'd put my name on a list. But they were only talking in terms of \$300, so I didn't care much."

#### WATCHING HISTORY

## ... Synthetic Take-Over

Man-made rubbers, says Herbert H. Fink of Goodrich Co., are setting new performance records in hose, rubber belting and countless other industrial rubber products as well as in tires. Slowly but steadily, synthetics have captured the market.

(Continued)

# FOR HEAVY LIFTING. LOADING, TRANSPORTING-

Use the Allis-Chalmers Tracto-Shovel . . . Works Where Other Loaders Can't Operate

Use it for tough work in and around your plant . . . and on a variety of jobs, too. With quick-change attachments, the HD-5G becomes a fleet of machines in one . . . handles materials of all kinds - bulk. solid or packaged. Power, weight and traction enables this outfit to work in the toughest going. Steel tracks are not damaged by cullet, or other sharp, abrasive

materials. Two-speed reverse assures extra production on loading and stockpiling work.

skids, lifts and stacks pack-aged and palletized loads. Lifting height (under fork), 8 ft. 10 in.; capacity, 4,000 lb.

CHOICE OF FOUR BUCKETS Handle countless digging, loading, stockpiling and reclaiming jobs. Standard bucket, 1-yd. capacity. Also 2-yd. Light Materials Bucket, 3/4-yd. Narrow Bucket and 1-yd. Rock Bucket.

CRANE HOOK for heavy-duty service. Lifts, carries and unloads. Capacity, 5,000 lb. Lifting height, 11 ft. 6 in.

angledozer blades, Trench Hoe, Tine Fork, Rock Fork, Drag Bucket, Teeth for all buckets.

evel se useful is available

how to MOVE MORE MATERIALS with less manpower, less equipment

# FOR HAULING AND SWEEPING-

#### Use the Allis-Chalmers IB

Built low, fast, powerful, the IB is the ideal industrial wheel tractor. It hauls trailers easily and safely up steep ramps, through narrow aisles, over railroad tracks and rough planking. Runs on less than a gallon of fuel an hour in average operation. Equipped with crane, the IB lifts, moves and spots loads up to 2,000 lb. With easily-attached sweeper, it removes snow, dirt or trash quickly.



ALLIS-CHALMERS MANUFACTURING COMPANY, Tractor Division 1127 S. 70th Street, Milwaukee 1, Wisconsin

Please send complete information on equipment checked below:

☐ The Tracto-Shovel line from 1 to 4 cu. yd.
☐ Model IB Wheel Tractor and attachments

Address..



When you think of

# STAINLESS STEEL FASTENINGS

think first

of

# ANTI-CORROSIVE

Anti-Corrosive has millions of stainless fastenings in stock (probably the largest selection of varieties and sizes in the world) for immediate delivery. Anti-Corrosive has the exceptional production capacity that can fill your requirements beyond stock items faster, better!



# FREE-A-N Stainless Fastening Selector

This handy slide-chart instantly identifies A-N Nos. pertaining to stainless steel nuts, screws, bolts, rivets, cotter pins, washers; gives sizes and other data. Write for "Chart 52D" TODAY!

Anti-Corrosive

III PASTĖNINOS OP STAINLESS STEEL

Manufacturers of STAINLESS STEEL FASTENINGS

CASTLETON ON HUDSON, NEW YORK

QED, cont. . .

"About 65 percent of the new rubber used in the U.S. last year was man-made, with the industry producing at the rate of 850,000 tons a year." Fink says.

# STORING SURPLUSES

# ... LPG Goes Underground

Petroleum distributors need to store LPG during the summer months, at which time no one wants to buy liquid petroleum gas. But with the coming of winter, demand for these hydrocarbons jumps wildly. Storage, consequently, between June and September, company men say, is an untidy, if not an expensive problem.

To hold its summer surplus of LPG and propane, General Gas Corp. uses underground storage wells. At its Gibsland, La., installation, the company has recently set in two such wells—one for propane (30,000-bbl. capacity), the other for LPG mix (80,000-bbl. capacity at the present). Ultimate capacity of each reservoir will be 100,000 bbl. Other companies have dug storage wells, and in recent months, according to the Oil&Gas Journal, the underground storage business in the Gibsland-Shreveport area has increased spectacularly.

How a Well is Done—In the project conducted by General Gas, which began in April 1951, drill men went through cap rock for 1,090 ft. to reach salt. After drilling about 1,000 of open hole, a pipe was set in and cemented. Next tubing was put in.

To wash out a reservoir in the salt bed, General Gas circulated fresh water through the pipe and bed at a rate of 1,000 bbl. per day. Fresh water from Gibs Creek, which runs through company property, passed down the tubing, and salt water up the annulus, then to a disposal pond. After washing out the salt bed to a desired volume (determined by caliper surveys), propane or LPG to be stored was injected into the annulus. It then displaced salt water from the reservoir below.

When it wants to recover the stored hydrocarbons, General Gas will pump fresh water through the tubing and gets its hydrocarbons out. Although the water does not wet the LPG, it does moisten the propane. Consequently, reclaimed propane will be sent through a bauxite dehydrator.

-End

# MEMO (Continued from page 119)

statistics to work on your everyday problems: quality control, equipment design, experiment planning and the like. A down-to-earth approach to a new tool for the engineer; mathematics will play second fiddle to practice.

# The Ads Can Help You

Do you read the ads in Chemical Engineering? If you don't, you're in the minority.

For our latest survey work has shown that over 80 percent of our subscribers make it a point to follow our ads regularly.

Readership of our ads, we've found, is highest among those people who stand to profit most: chemical engineers in production, maintenance, development and design work.

Like the editorial sections of technical magazines, the ads help the reader keep his finger on the pulse of his industry. Their importance to the chemical engineer was very well put

in a letter we got recently from the works manager of a large petrochemical plant near Houston:

"I recently heard a production engineer say he didn't have the time to wade through (as he put it) the ads in the chemical engineering publications. Right then and there I marked him as a man who isn't keeping up with things."

"Put me down," he continued, "as a booster for the advertising pages . . . they're the best education any engineer can get."

# MATERIAL BALANCES (Continued from page 127)

 $as = s*(1.960) (n-3)^{-0.5} = e_f$ 

Where n is less than 25 and confidence limits other than 95 percent are desired, see Table I. Those interested in the derivation and significance of a are referred to the reference for Eq. (8). A discussion of that point is considered beyond the scope of this article. Briefly, the reference defines a as "the factor for computing the confidence limits associated with a desired value of probability and a given number of observations."

Substituting the value of  $e_t$  obtained from Eq. (8) into Eq. (7) gives the following expression:

$$e_W = as (2W^2 - 2W + 2)^{0.5}/(b-p)$$
 (9)

SHORT-CUT CHARTS

When the approximate values of (b - f) and (b - p) are known a chart similar to Fig. 1 facilitates calculation of allowable error (as). The chart was drawn based on values for (as) or e, obtained by solving Eq. (9) using various values for W and recovery confidence limits of  $\pm 0.01$  ( $\pm 1.0$  percent). As shown by Eq. (7) the error in recovery varies directly as the error in the feed. Thus if any confidence limit other than  $\pm 0.01$  is desired, the reading obtained from the chart (Fig. 1.) is in the same proportion as the new confidence limits. That is, if confidence limits of  $\pm 0.03$  or  $\pm 0.04$  are desired the values obtained from the chart are multiplied by three or four respectively.

Fig. 2 is a plot of the data obtained if the error in the product is neglected. This makes the last term of Eq. (6) equal to zero. Since most operations strive for a uniform product from at least one end, it is believed Fig. 2 more nearly represents actual practice than does Fig. 1.

Before the number of required samples can be determined, the standard deviation of the feed stream component analysis must be known. The standard deviation is a measure of the fluctuations in the feed stream composition. Either preliminary sampling or a backlog of stream composition data will establish the standard deviation.

Number of samples required to estimate the standard deviation will be a function of the amplitude and frequency of cycling. Thus when the cycling is rapid and the fluctuations are large, a greater number of preliminary samples are needed than if the reverse is true.

After the allowable error and standard deviation have been determined the number of samples required is calculated from Eq. (8). To facilitate determining the number of samples a nomograph (Fig. 3) has been drawn of this equation based on a 95 percent confidence limit. It should be noted that the nomograph has incorporated the data in Table I for values of *n* less than 25.

#### SAMPLE CALCULATION

A sample calculation will help clarify the use of the charts. Preliminary data on a separation operation may indicate component concentrations in the feed, product and bottoms of 40, 10 and 60 percent respectively. Also the standard deviation is found to be 3.0.

From these data (b - f) and (b - p) are calculated to be 20 and 50 respectively. Fig. 1 then yields a value of 0.4 for  $e_f$ . Recovery can also be obtained from Fig. 1 by following the intercepted diagonal line to the right ordinate.

By using Fig. 3 the number of samples necessary for the required precision is determined. This is done by joining the known values of  $e_r$  and s with a straight line. The number of samples is shown at the point where the straight line intersects the diagonal (220 samples). If a confidence limit of  $\pm 0.02$  is satisfactory then  $e_r$  is 0.8 and only 56 samples would be required.

If errors in sampling the product are considered negligible, then Fig. 2 would be used. In that case e, is 0.43 and 200 samples would be required for a confidence limit of 0.01; 48 samples for a confidence limit of 0.02.

Fig. 3 shows that as the standard deviation increases the number of samples required for a given accuracy or confidence limit increases. For the example cited above, if the standard deviation is doubled to 6.0 the number of samples required for  $c_7 = 0.4$  would be about 1.000. Halving the standard deviation to 1.5 drops the required number of samples for the same  $e_7$  to 65.

In evaluating poorly controlled operations where successive samples show wide fluctuations this method has proven satisfactory for obtaining plant recoveries.

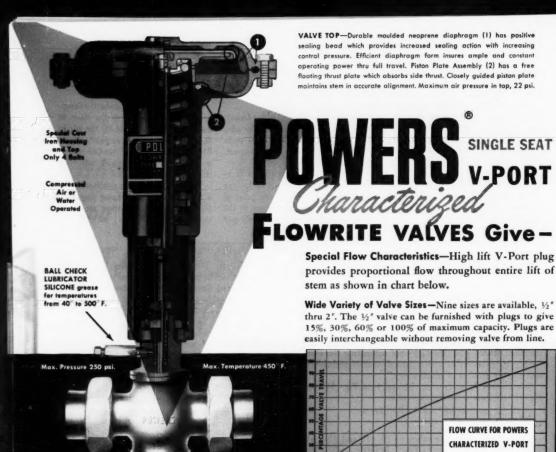
REFERENCES :

1. Worthing, A. G., and Geffner, J., "Treatment of Experimental Data," p. 208, John Wiley & Sons (1943).

2. ASTM Manual on Quality Control of Materials, Special Technical Publication 15-C, (Jan. 15, 1951).

where n is the number of observations and  $\overline{x}$  is the arithmetic mean of n observations.

<sup>\*</sup> s =  $\sqrt{\frac{(x_1 - \overline{x})^2 + (x_2 - \overline{x}) + \dots (x_n - \overline{x})^2}{n}}$ 



Direct and Reverse Acting

SEPARATE SHUT-OFF

SEAT

SIZES: 1/2" thru 2

RENEWABLE

PLUG and SEAT

Stainless Steel

Better Control—Less Mointenance—Superior design of stainless steel plug and seat reduces wire drawing, insures longer life and tight shut off. V-Ports do the throttling, protecting separate shut off seat. Plug and seat are truly removable and can be easily replaced in the field. Inner valves are machined

and precision ground and lapped within very close tolerances.

Low Hysteresis—Due to smooth rolling diaphragm and polished stainless steel stem in preformed lubricated packing.

Easy to Adjust—Ball bearing adjusting screw; rust proofed steel calibrated springs with full travel in 5 or 10 psi.

Easy to Install—Powers Flowrite V-Port valves have double unions and bronze body with rugged construction to withstand piping strains.

Eosy to Service—Valve and top are easy to take apart and re-assemble, facilitating inspection and maintenance.

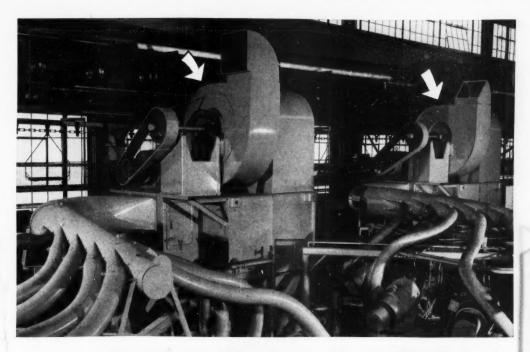
Reasonably priced. Contact our nearest office for prices and assistance in selecting proper size valves

# THE POWERS REGULATOR CO.

SKOKIE, ILLINOIS . Offices in Over 50 Cities

Chicago 13, III., 3819 N. Ashland Ave. e New York 17, N. Y., 231 E. 46th Street Los Angeles 5, Cel., 1808 West 8th Street e Toronto, Onterio, 193 Spedime Ave. Mexice, D. F., Apartade 63 Bis. e Honolulu 3, H. I., P. O. 2755—450 Pilkol et Kong

OVER 60 YEARS OF TEMPERATURE AND HUMIDITY CONTROL



# Another Clarage Installation in One of America's 97\* Largest Industrial Enterprises

\*97
OF AMERICA'S
100 LARGEST
CORPORATIONS

are users of Clarage equipment . . . This wide acceptance denotes the high quality and reliable performance of Clarage products. Above you see two of the twelve Clarage Improved Exhausters on a vital-to-production dust collecting job in the Monroe, Michigan plant of the Ford Motor Company.

These twelve fans operate in connection with twelve American Air Filter Company's Roto-Clone installations.

Ford Motor Company has used Clarage equipment for over a quarter century.

Counting all of this Company's plants, well over a thousand Clarage fans are now handling the many and varied air handling requirements of this leading automotive and defense materiel manufacturer.

You can RELY on Clarage equipment to give you economical service for a long time to come. C L A R A G E F A N C O M P A N Y . 637 Porter Street, Kalamazoo, Michigan



# Fluid Mixing



The complete line of Eastern Mixers offers a selection to fit your needs for mixing all types of fluids under a wide variety of operating conditions. Eastern engineers are always available to work out your mixing problems with you.

# SEND FOR SERIES OF CATALOGS



For complete information and engineering data, write for "Eastern Fluid Mixing Catalogs, Series 1".



Eastern Industries, Incorporated

\* 296 Regent Street

East Norwalk, Conn. \*

# Chemical Engineer's Bookshelf Edited by Lester B. Pope

#### Short of the Target

SYNTHETIC RESINS AND ALLIED PLASTICS. Third edition. Edited by R. S. Morrell and H. M. Langton. Oxford University Press, London, New York, Toronto. 747 pages. \$10.

Reviewed by F. C. Nachod

This well known compendium which first appeared in 1937 is now available in its third edition cared for by Dr. Langton since the original editor, Dr. Morrell, died in 1946. Some of the chapters have been modernized (alkyds, hydrocarbon and rubber resins, shellac, cellulosic plastics) but the remainder show little evidence of modernization. As examples, ion exchange resins and silicone rubbers and plastics are dealt with cursorily in four and eight pages, respectively, in the chapter covering "miscellaneous resins" which certainly does no justice to the commercial and industrial importance gained by these products. Similar cases may be found elsewhere in the book.

Hence this reviewer feels that the book is of limited value and that it is regrettable indeed that the effort of bringing the text up-to-date has fallen short of what one might expect.

#### Fine Balance

MEDICINAL CHEMISTRY, Vol. II. By A. Burger. Interscience Publishers, New York. 506 pages. \$10.

Reviewed by E. A. Steck

A synthesis of Prof. Burger's experience in chemistry and depth of understanding of medicinal topics has produced a two volume work of real merit. The first volume considered topics of pharmacological interest; the present one, those more related to chemotherapy. The fine balance which has been maintained in the use of historical material and introduction of pertinent biological aspects is commendable, and the choice of references has been excellent (there are even numerous references to literature appearing in 1951). Judicious use of trade names has been coupled with a well arranged index to make the work valuable to those having industrial contact with medicinals.

It is fortunate that this thoroughgoing set, with few errors in content, should have been given careful handling by all involved in its publication. There is every reason to suppose that it will be able to withstand the vigorous use it merits at a just price.

#### British Rules

SAFETY RULES FOR USE IN CHEMICAL WORKS. PART II. Association of British Chemical Manufacturers, 166 Piccadilly, London. 282 pages. \$6.

Reviewed by H. H. Fawcett

The Association of British Chemical Manufacturers corresponds roughly to the Manufacturing Chemists' Association. In this attractively bound and neatly printed volume, the detailed safety precautions, which are recommended by the Works Safety Committee of the British Association, are recorded. Part of this work was originally drafted in 1930, but has been completely revised to reflect current thinking.

Even a cursory glance at this book will impress the American reader with two points: (1) the extremely high degree of government regimentation and, (2) the differences betweeen current American and British viewpoints on many subjects. As for the first, Chapter 1 on legislation spells out the Factory Acts of 1937 and 1948, and indicates in the 58 pages that if legal requirements can prevent accidents (which, of course, they cannot by themselves), British industry must be completely safe. The main chapters following discuss safety organization, fire, explosions, gassing, poisoning and dust inhalation, effects of corrosive materials, cleaning of and entry into confined spaces, "permit to work" certifi-cates, medical and first aid services, working conditions, and protective clothing and appliances. Most of these rules, regulations, and medical treatments correspond with accepted American practices, and appear fundamentally sound

We note with interest that methyl bromide is still used as a fire extinguisher, but find no mention of dry chemical agents (although we understand they are being used to some extent in Britain). Self-contained breathing apparatus, in which the user carries a cylinder either of compressed air or oxygen, is described, but equipment similar to the Chemox is apparently not used. The Schaefer's method

of artificial respiration is outlined in detail, but the recently approved armlift, back-pressure technique being taught in America is not mentioned. Industrial hygiene techniques for detection of toxic substances are listed, and it is noted these do not mention such instruments as the G.E. Type H Leak Detector (for halogen-containing leaks), the Davis Halide Meter, or the G.E. mercury vapor detectors, the M.S.A. Aromatic Hydrocarbon Detector, or the Beckman Paramagnetic Oxygen Analyzer. It would be highly interesting to study such differences in techniques and instrumentation in detail, since more and more attention is being given in both countries to the measurements and correction of atmospheric and stream contamination.

In general, the book is recommended to anyone concerned with the diverse problems of accident prevention in which chemicals in any amounts are involved. It will be of especial interest to safety personnel in the larger plants, but should not be overlooked as a reference by anyone concerned with safety in any chemical operation. The British are to be commended for this contribution to chemical safety literature.

#### The Classic

DIFFUSION IN SOLIDS, LIQUIDS, GASES. By W. Jost. Academic Press, New York. 558 pages. \$12.

Reviewed by John Bowman

This book treats its subject in the comprehensive style of the German handbuch. It includes an essentially complete bibliography (over 2,000 references) of the many subjects related to diffusion processes. The emphasis throughout is theoretical, but a very large amount of experimental data from the literature is included as meat for the theory.

More specifically, the following list of chapter titles will illustrate the scope of the book.

I. The Fundamental Laws of Diffusion

II. Disorder in Crystals

III. Theory of Diffusion in Solids IV. Electrolytic Conduction and Diffusion in Ionic Crystals

V. Diffusion in Metals and in Non-Polar Crystals

VI. Solubility in Solids VII. Permeation and Diffusion of (Continued)

# B. W. Regers Co. 850 So. High St. (9) Carey Mackinery & Supply Co. 3501 Brehms Lone (13) Whitehead Metal Products Co. 4300 E. Monument St. (5) Standard Brass & Mfg. Co. 705 Milam St.

705 Milom St. A. E. Borden Co., Inc. 176 Brookline Ave. (15) Whitehead Metal Products Co. 2128 Elmwood Ave. (7) Whitehead Metal Products Co. 281 Albony St. (39) Globe Machinery & Supply Co. 309 8th Ave., S.E.

Wallace Tube Co. 1300 Diversey Parkway (14)

1300 Diversey Parkwey (14) Williams & Co. (29) W. M. Partinon Supply Co. 777 Backelli A. Land (14) B. W. Rogerial A. (15) Williams & C. (15) Williams & Co. 3700 Parkins Ave. (14) Williams & Co. 851 Williams Ave. (8) Metal Good Corp. 6211 Cedar Springs Md. (9) Clobe Machiner & Supply College Machiner & College Machiner &

Globe Machinery & Supply Co. 410 East Second St.

Metal Goods Corp. 2425 Walnut St. (2) Globe Machinery & Supply Co. East First & Court Ave. (6)

J. N. Fauver Co. 49 West Hancock St. (1) Whitehead Metal Products Co. 1000 South Fourth Ave.

Metal Goods Corp.
711 Milby St. (3)
Standard Brass & Mfg. Co.
2018 Franklin St. (1)
Metal Goods Corp.
1300 Burlington Ave.
North Kansas City (16)

412 E. 5th Ave. (5)
Haskel Engineering & Sup. Co.
721 W. Broadway,
Glendole (4)
Metropolitan Supply Co.
353 East 2nd St. (12)
J. E. Dilworth Co.
730 South Third St.

Morman Belting & Supply Co. 522 W. State St. (3) Wallace Companies of Wisconsin, Inc. 838 So. 6th St. (4)

Vincent Brass & Copper Co. 124 Twelfth Ave., So. (15)

Noland Company 27th St. & Virginia Ave.

R. W. Hudgins & Son 3 Commerce St. (10)

Whitehead Metal Products Co. 303 West 10th St. (14)

3 Commerce St. (10)
Louis H. Hein Co.
15 West Lancaster Ave.
Ardmore, Pa.
Whitehead Metal Products Co.
1955 Hunting Park Ave. (40)
Williams & Co.
901 Pennsylvania Ave. (33)
Hydraulis Pawer Fauliment Co.

Hydraulic Power Equipment Co. 2316 N. W. Savier St. (10)

2316 N. W. Savier St. (10)
Noland Company
11 Salem Ave. (10)
Rockford Tool & Transmission Co.
820 Broadway
General Machinery & Sup. Co.
1346 Felsom St. (3)

1346 Folsom St. (3) Eagle Metals Co. 4755 First Ave., South (4) Metal Goods Corp. 5239 Brown Ave. (15) Whitehead Metal Products ( 207 West Taylor St. (4)

Williams & Co. 650 E. Woodruff Ave. (2) Metal Goods Corp. 302 North Boston (3)

Reading, Pa.
Railway & Power Engineering
Corp. Ltd.

Mercator Corp. 438 Wainut St.

cts Co.

Metal Goods Corp 432 Julia St. (13)

Leinart Engineering 412 E. 5th Ave. (5)

J. N. Fauver Co. 1534 Keystone Ave. (10)

AKRON, O. BALTIMORE, Md.

BEAUMONT, Tex. BOSTON, Mass. BUFFALO, N. Y. CAMBRIDGE, Mess. CEDAR RAPIDS, Ia. CHICAGO, III.

CINCINNATI, O. CLEVELAND, Q.

COLUMBUS, O. DALLAS, Tex. DAVENPORT, Ia. DAYTON, O. DENVER. Colo. DES MOINES, Ia. DETROIT, Mich. HARRISON, N. J. HOUSTON, Tex. KANSAS CITY, Mo.

KNOXVILLE, Tenn. LOS ANGELES, Cal.

MEMPHIS, Tenn. MILWAUKEE, Wis.

MINNEAPOLIS, Minn. NEW ORLEANS, La. NEWPORT NEWS, Va. NEW YORK, N. Y. NORFOLK, Va. PHILADELPHIA, Po.

PITTSBURGH, Pa. PORTLAND, Ore. ROANOKE, Va. ROCKFORD, III. SAN FRANCISCO, Cel. SEATTLE, Wash. ST. LOUIS, Me. SYRACUSE, N. Y. TOLEDO, O. TULSA, Okla

EXPORT CANADA BOOKSHELF, cont. . .

Gases in Solids VIII. Mobility of Ions in Solid and Molten Metals and Alloys

IX. Surface Reactions of Metals, Formation of Protective Layers and Related Reactions

X. Diffusion in Gases XI. Diffusion in Liquids XII. Thermal Diffusion.

The book will be useful to a wide range of scientific professions from chemical engineering to solid state physics. It is, however, essentially a reference book, being too voluminous to be useful as a text except in a highly specialized, advanced course. As a reference book, however, it is undoubtedly destined to be the classic in its field for many years to come.

Physically the work is excellently presented. With the exception of a few obvious and trivial typographical errors, the printing is excellent, and the paper and binding appear to have the durability generally required of this type of work

# Recent Books & Pamphlets

## Subject Professional Engineers

#### Summary

# A compilation of past examinations

of the University of the State of New York from January 1943 through February 1952. The candidate preparing for the exam can get an idea of its nature and form together with something of its breadth and coverage. 78 pages.

Fats and Oils

Appraisal of the present and potential effects of newer processing methods on the inedible fats and oils markets in industrial fields. 44 pages.

International Engineering

Twenty-three lectures by chemical engineers from ten different countries delivered at the recent Achema X convention. They cover such themes as basic chemical engineering, automatic measuring and control devices in the laboratory and works, continuous chemical processes, materials and corrosion. 500 pages.

Sulphur

Review of production and consumption in Canada. Description of possible alternative sources of domestic supply as well as the vast reserves of pyrites which are known to exist. 103 pages.

Northwest Industry

Lists manufacturing companies, their location and products. 12 pages.

Clavs

Methods of investigation of geology and ceramic tests, and application of differential thermal analysis of clay mineralogy in general and the geology of the Buena Vista, Calif., area. This area is one of the most important clay-producing areas of California and is the source of the lignite which supplies one of the two operating montan wax plants in the United States. 39 pages.

#### How to Order

By John D. Constance. 625 Hudson Terrace, Park, N. J. \$1.50. Cliffside

"Marketing of Nondrying Industrial Fats and Oils Affeeted by Processing Methods." By Morris V. Sills. Dept. of Agriculture, Produc-tion and Marketing Administration, Fats and Oil Branch, Washington, D. C.

Decema, Deutsche Gesellschaft fur chemisches Apparatewesen, Frankfurt am Main 13, Postfact, Germany. DM 33.75

"Sulphur and Pyrites In Canada." By T. H. Janes. Dept. of Mines and Technical Surveys, Mines Branch, Ottawa, Canada.

"Principal Chemical and Metallurgical Industries of the Pacific Northwest." By C. K. Sterrett. Information Circular No. 3. 701 Wood-lark Bldg., Portland 5, Ore.

Special Report 19. By Joseph A. Pask and Mort D. Turner. California Division of Mines, Ferry Bldg., San Francisco 11, Calif. 75 cents.

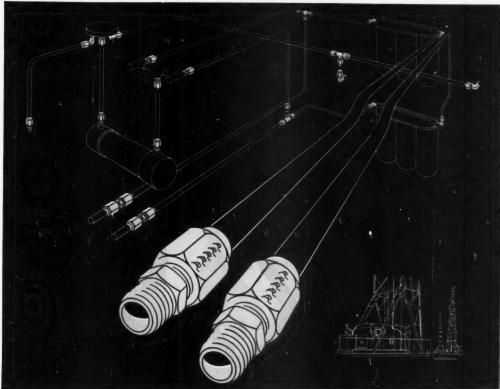


Illustration based on Unit Rig oil filter system, Courtesy Unit Rig & Equipment Co.

## Tube it up...Forget it!

### WITH ALUMINUM TRIPLE-LOK FITTINGS

This does it



Triple-lok . . . 3-piece flare fitting famous for its sleeve . . . the easiest way to install tubing systems. Made in brass, steel, stainless steel, aluminum alloy.

Precision Mark of



In the oil fields, for example, where equipment is out in the open, subject to all kinds of atmospheric conditions. Here you'll find precision-made, corrosion-resistant, leakproof Parker Allminum Triple-lok Fittings on many types of equipment. Such as the versatile Unit Rig draw works . . . with Allminum Triple-lok on oil filter, oil pump, and air supply lines.

PARKER ALUMINUM Triple-lok Fittings are designed and precision made to be leak proof under even the severest conditions of vibration—elevated temperatures—high pressures—and repeated reassembly . . . and to hold leakproof beyond tube bursting pressures. That's why you'll find them on oil field equipment . . . on control lines for delicate instrumentation . . . wherever failure-proof tubing systems are demanded.

So tube it up and forget it . . . with PARKER Triple-lok Fittings. Distributors listed alongside now have stocks of ALUMINUM Triple-lok Fittings in the popular, medium sizes.

FOR PARKER Tube Fitting Catalog 4300, call your PARKER Distributor, or write The PARKER Appliance Company, 17325 Euclid Ave., Cleveland 12, Ohio.

DOTTE STEEL TUBE FITTINGS - VALVES - O-RINGS

Plants in Cleveland • Los Angeles • Eaton, Ohio • Berea, Ky.

## saves



FIBER DRUM with VISQUEEN LINER

A sure way to save on hydroscopics.
Visqueen locks out moisture, prevents lumping or caking. Use this combination for your most "difficult" products, even wet or greasy.



STEEL DRUM with VISQUEEN LINER
No leakage. No cleaning or reconditioning. 100% recovery and purity. VISQUEEN prevents any reaction from metal, doesn't stick or cling no matter how messy or sticky product is.



## money in every weigh



RECTANGULAR CARTONS with VISQUEEN VISQUEEN film liners may be used for any size rectangular cartons, for low cost, convenient shipping of foods and other products in semi-liquid or solid form. Investigate this new packaging technique

### IMPORTANT!

VISQUEEN film is all polyethylene, but not all polyethylene is VISQUEEN. VISQUEEN is the only film produced by process of U. S. Patent No. 2461975. Only VISQUEEN has the benefit of research and extensive technical experience of The Visking Corporation, pioneers in the development of polyethylene film.

# 3 VISQUEEN packaging methods to save up to 66% shipping costs— guarantee 100% product purity!

Shippers of liquids, (corrosive or not), semi-liquids or solids no longer are forced to pay the heavy tare price of containers which often weigh as much, if not more than the product itself. Visqueen film liners in fiber drums, steel drums and cartons combine full, 100% product protection with big reductions in weight.

Example: a VISQUEEN liner and "boot" in a fiber drum is 50 to 75% lighter than alternative containers, and successfully carries 400 lbs. of liquids for a manufacturer under all types of normal handling abuse. Approved by the American Trucking Association. Accidental falls and bumps which might shatter rigid containers, leave VISQUEEN unaffected because of its high tensile strength, uniformity and flexibility.

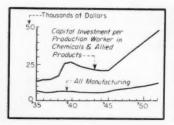
These money-saving VISQUEEN applications resulted from closely-knit teamwork between VISQUEEN and VISQUEEN converters. Converters who have VISQUEEN'S superior technical resources and vast experience at their command. The only ones in their field who can put VISQUEEN engineers and chemists in your plant to work on your problem . . . to make sure the better packaging that always spells economy.

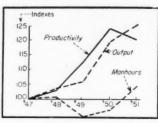
Write for a complete list of VISQUEEN converters in your area. Do it better—do it with VISQUEEN.

VISQUEEN film...a product of THE VISKING CORPORATION

Preston Division, Terre Haute, Indiana • In Canada: Visking Ltd., Lindsay, Ontario

\*T.M. The Visking Corporation





### **Chemical Labor Output Goes Up**

Output per manhour is up some 20 percent since 1947. But capital investment per worker now hits close to \$48,000—four times the average for all manufacturing.

The individual production worker in chemicals and allied products is helped by four times as much capital equipment as the average worker in the manufacturing industries.

Every production worker in the chemical and allied products industries is backed up by almost \$48,000 of capital investment.

This compares to an investment of somewhat over \$10,000 per worker in automobile production, about \$9,500 per worker in iron and steel and less than \$4,000 in apparel. The average capital outlay per worker in all manufacturing is \$12,000.

▶ Productivity Defined—Productivity is a measure of output. Statistics on productivity compare the production of goods with the input of the necessary ingredients.

Studies on productivity usually are confined to measuring output per worker or per manhour of labor.

Productivity increases are usually associated with investment in laborsaving machines. But that's not the whole story. The increase in labor productivity often arises as a result of changing the method of production or switching to new materials.

Productivity is not a measure of labor's on-the-job effort. Mining coal in France is a difficult and laborious task. Yet the French miner is only one sixth as productive as his American counterpart.

From these illustrations it can be seen that productivity is an overall reflection of management's skill in combining equipment, labor and materials in such a way as to give the lowest unit cost.

▶ Chemical Productivity—The index of productivity for chemicals is calculated by dividing an index of output by an index of manhours.

Output per manhour in chemicals rose spectacularly from 1947 through 1950. Over this three year period the productivity index rose by 24 percent.

But from 1950 to 1951 the index fell off a bit. The reason is not hard to find. During 1951 a lot of brand new plant equipment was put in place as the industry expanded in response to the mobilization program. It takes months to get new capacity shaken down and all the bugs ironed out. In addition, new workers were drawn into the field as capacity expanded; and it takes some time before the latest addition to the labor supply acquires the skills of the more experienced workers.

It's important to bear in mind that an index of output per manhour in chemicals does not do full justice to the productive capacity of the workers. There are so few workers, comparatively, required in production that the productivity of the average worker is bound to be extremely high.

Ordinarily, sharp increases in productivity come about when introduction of new machinery makes it possible to cut down on the number of workers. But in chemicals the number of workers is so low to begin with that the opportunities for further reduction are limited.

Despite this limitation imposed by the nature of the chemical production process, the index of output per manhour compares favorably with figures for other industries.

From 1939 to 1951 the annual rate of change in productivity for anthracite coal mining was -1.3 percent. For machine tools the figure is -0.4 percent. Electric light and power-a growth field-maintained a productivity increase of 3.7 percent over the period. For all industry the annual increase in output varies between 1.6 percent and 2.2 percent.

Spending and Expansion—The tremendous capital investment required per worker in chemical and allied products explains the huge spending plans of the industry as well as the record pace at which capacity has been enlarged.

Year after year the McGraw-Hill survey of business' plans for new plants and equipment shows that chemicals and allied industries consistently lead the way as far as capital spending is concerned.

And no real let-up is in sight. Chemical capital outlay, according to present plans, will top \$6.4 billion between 1951 and 1955. National Production Authority "certificates of necessity" for chemicals, issued and pending, total more than \$2.5 billion.

During the past 25 years, chemical manufacturing has been expanding at an average rate of 10 percent a year. The average rate of growth for all industry is 3 percent annually.

Adding it all up, it's plain that the growth prospects in chemicals do much to assure good business conditions for the whole economy. Private capital spending is a crucially important factor in the economic outlook. Growth in chemicals requires huge capital outlays; that's in the nature of the industry.

In addition, private capital spending in chemicals boosts productivity. That makes it possible for chemical workers to get higher wages, company shareholders to get higher dividends, and industrial users and consumers to receive the benefits of lower prices. Do You Know the "Ins and Outs" of these

# Sequestering Agents?



You can put "in" Pfizer Citric or Gluconic Acid—or one of their derivatives"— to sequester "out" the metallic contaminants which interfere with efficient operation in your plant.

Pfizer Citrates and Gluconates are recom-

Pfizer Citrates and Gluconates are recommended as sequestering agents in...

The textile industry...to inactivate trace metals in dyeing, bleaching, kier boiling and mercerizing.

The leather industry...to adjust tanning solutions to the proper pH without precipitation.

Oil and fat industry...to inactivate trace metals which lead to rancidity.

Weed killer formulations...to prevent formation of insoluble, inactive salts in hard water greas.

Municipal and industrial water systems...to prevent the precipitation of metallic contaminants.

\*Sodium Citrate, Sodium Gluconate, Ammonium Gluconate

PUT "IN"	SEQUESTER	"OUT"	рН
CITRIC	Iron (Ferric)	19 Parts	7
ACID Sequestering action of	Copper Zinc Cobait	26 Parts 44 Parts 95 Parts	7 7 10
100 parts of acid			10
GLUCONIC	Iron (Ferric)	24 Parts 4 Parts	7

26 Parts

27 Parts

6 Parts

10

Pfizer has a wealth of information on the effectiveness of these Citrate and Gluconate sequestering agents. For additional data, write:

7ine

Cobait

CHAS. PFIZER & CO., INC.

630 Flushing Ave., Brooklyn 6, N. Y. Branch Offices: Chicago, Ill.; San Francisco, Calif.; Vernon, Calif.

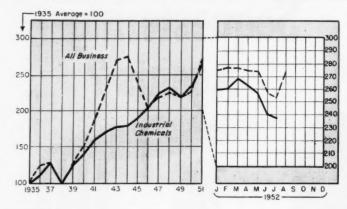
Manufacturing Chemists for Over 100 Years



PFIZER

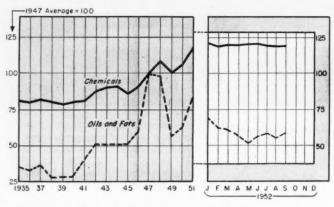
## Process Industry Trends

### CONSUMPTION



Industrial Chemicals Index			
	July (Est.)	June (Prelim.)	May (Revised
INDEX	238.00	241.70	256.67
Fertilizer		56.49	64.58
Pulp and paper	25.23	27.27	28.90
Petroleum refining	28.06	26.46	16.58
Iron and steel	2.94	3.01	15.16
Rayon	28.20	25.81	23.62
Gless		23.17	23.20
Paint and varnish		29.46	30.49
Textiles		10.62	9.94
Coal products		5.59	9.70
Leather		4.17	4.17
Explosives		8.23	9.07
Rubber	5.28	5.85	5.91
Plastics		15.57	15.35

### PRICES

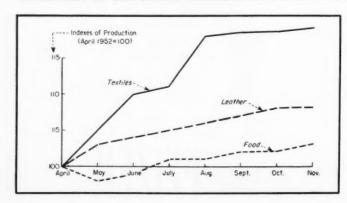


### Chemical Engineering's Price Indexes

Chemicals DOWN - 0.1% Oils and Fats: UP + 5.4%

	Chemicols	Oils &
As of Sept. 1, 1952	119.47	58.30
Lost month	119.57	55.30
Sept. 1951	119.24	74.29
Sept. 1950	107.85	71.46

### HIGHLIGHT OF THE MONTH



### Customers' Production Up And Chemical Sales Follow

As output goes up in industries which consume large quantities of chemicals, chemical sales also go up. Current outlook for textiles, manufactured foods, leather, pulp and paper is very good. Recent statistics indicate upturn in these industries has already taken place. Expectations are for continued high level activity until the end of the year. This adds up to a better than current picture for the chemical industry.



### **Test Pilot**

"Just try those springs," the salesman says and his customer, canny as well as pretty, takes him at his word. She wants to be sure what she's getting.

Testing is a good way to double-check Multiwall bags too. Subject them to the toughest going you can. Make sure your manufacturer checks them also—continuously and against rigid performance standards.

In Union's testing laboratories, Multiwalls have to prove themselves constantly—for strength, durability, moisture resistance, sift-proofness, every characteristic you expect of a good package.

Union Multiwalls are uniformly high standard. They are manufactured in the world's largest integrated pulp-to-container plant. Only in an integrated plant can first-hand control be maintained over every step of the process by which your package is made.

Best proof of the value of this extra protection is in the buying habits of America's largest Multiwall users. Men who purchase more than 85 per cent of the total production of Multiwalls list\* dependable quality as one of their most important considerations in choosing a Multiwall supplier.

Insistence on uniformly high manufacturing standards is one of the many good reasons why, to a greater extent each year, these major buyers turn to Union for a substantial share of their increased Multiwall requirements.

More so every day . . .



### IT'S UNION FOR MULTIWALLS

### New Construction

#### Proposed Work

- Ariz., Florence—Proven Oil & Refining Co., c/o L. M. Glascop, M & W Tower Bldg., Dallas, Tex., plans to construct a gasoline refinery near Florence. Estimated cost \$17,-937,000
- Calif., El Segundo—Standard Oil Co. of California, 225 Bush St., San Francisco, plans to construct a catalytic cracking unit here. Estimated cost \$20,000,000
- Calif., Los Angeles—Union Carbide & Carbon Corp., 2770 Leonia Blvd., plans to construct a Polyethylene plant. Estimated cost \$36,-000 000.
- Calif., Watson—Richfield Oil Co., 555 South Flower St., Los Angeles, plans to expand its catalytic cracking unit here. Estimated cost \$40,000,000
- Mich., Edmore—Carbolov Co., Inc., Edmore, plans to construct a factory here. Smith, Hinchman & Grylls, 800 Marquette Bldg., Detroit, Archts. Estimated cost \$3,000,000
- Tenn., Memphis—W. R. Grace & Co., 7 Hanover Sq., New York, N. Y., plans to construct an anhydrous ammonia plant here. Estimated cost \$15,000,000
- Tex., Bavtown—Consolidated Chemical Industries, Inc., 111 Sutter St., San Francisco, Calif., plans to construct a sulphuric acid plant here. Estimated cost \$6,500,000
- Tex., Houston—Continental Oil Co. & Associates, Sterling Bldg., plan to construct a petrochemical plant. Estimated cost \$15,-000,000
- Tex., Orange—Allied Chemical & Dve Corp., Orange, plans to construct an Ethylene Glycol plant. Estimated cost \$5,675,000
- Tex., Texas City—Carbide & Carbon Chemicals, Div. of Union Carbide & Carbon Corp., Texas City, plans to enlarge its chemical plant here. Estimated cost \$13,-873,000
- W. Va., Moundsville—National Audine Corp., Div. of Allied Chemical & Dve Corp., 40 Rector St., New York, N. Y., plans to construct a plant for the manufacture of nitrobenzone and anilines. Estimated cost \$2,-300,000

### Contracts Awarded

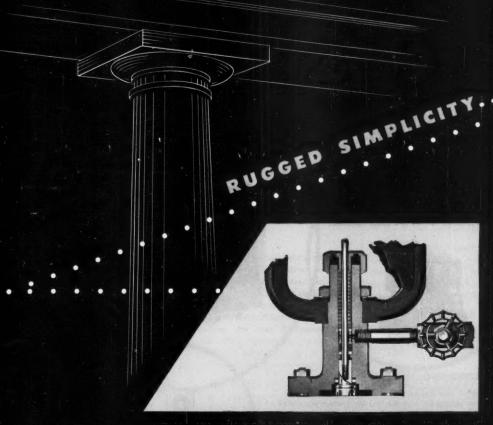
- Calif., Vernon—Filtrol Corp., 272 West 7th St., Los Angeles, has awarded the contract for a plant to manufacture high-purity alumina and ammonium sulphate to be used in petroleum refining to J. H. Pomeroy Co., Inc., 333 Montgomery St., San Francisco. Estimated cost 55,000,000
- Fla., Tampa—American Lather & Solvent Co., c/o E. Henry, Tampa, will construct a plant here. Work will be done by owner. Estimated cost will exceed \$82,000
- Ga., Atlanta—Atlanta Paper Co., 950 Mariette St., N. W., will construct a new plant. Work will be done by owner. Estimated cost \$120,000
- Ill., Chicago—Central Solvents & Chemical Co., 2545 West Congress St., has awarded

	Current F	rojects
	Proposed Work	Contracts
New England	*********	\$12,590,000
South	\$17,300,000	15,672,000
Middle West	3,000,000	1,495,000
West of Mississippi Far West	41,048,000 113,937,000	22,735,000 5,000,000
Canada		3,000,000
Total	\$175,285,000	\$57,492,000

Work	Contracts
\$7,000,000	\$2,992,000
43,450,000	55,535,000
380,065,000	219.479.000
63,830,000	116,280,000
588,636,000	379,612,000
128,665,000	31,588,000
162,833,000	45,388,000

- the contract for a warehouse and office to Krahl Construction Co., 250 N. Clark St. Estimated cost \$300,000
- Ill., Chicago—Ninol Laboratories, 1719 South Clinton St., have awarded the contract for a laboratory to J. E. LeFevre, 1235 W. Grand Avc. Estimated cost \$120,000
- Ill., Chicago—Time Chemical Co., 4828 S. Horne St., has awarded the contract for a factory to A. J. Siegel Co., 30 N. LaSalle St. Estimated cost \$175,000
- Ill., East St. Louis—Morris Paint & Varnish Co., 15th St. and Southern Rv. tracks, has awarded the contract for a 10,000 sq. ft. warehouse to Walter Remelius, Clarita Ave.
- Ind., East Chicago—Sinclair Refining Co., 350 Indianapolis Ave., has awarded the contract for a plant addition to Sumner S. Sollitt, 307 North Michigan Ave., Chicago. Estimated cost \$400,000
- Ind., Hammond—Standard Oil Co., 910 S. Michigan Avc., Chicago, Ill., has awarded the contract for an engineering building addition to Poirot Construction Co., 2001 Pershing Rd., Chicago. Estimated cost \$400,000
- Mo., St. Louis—Monsanto Chemical Co., 1700 S Second St., has awarded the contract for a 2 story, 42x58½ ft. concrete compressor structure to Fruin-Colnon Contracting Co., 1706 Olive St.; also a service building to H. B. Deal & Co., Inc., 5517 Manchester Ave.
- Mont., Billings—Carter Oil Co., Billings, has awarded the contract for design and construction of catalytic polymerization unit and waste heat boiler auxiliary at refinery to Blaw-Knox Co., Farmers Bank Bldg., Pittsburgh, Pa.
- N. J., Morris Plains—Warner-Hudnut, Inc., 113 W. 18th St., New York, N. Y., has awarded the contract for design and construction of pharmaceutical products plant to Walter Kidde Constructors, 140 Cedar St., New York, N. Y. Estimated cost \$2,500,000
- O., Woodville—Atomic Energy Comn., 1901 Constitution Ave., N. W., Wash., 25, D. C., has awarded the contract for a gaseous diffusion process uranium plant here to Peter Kiewit Sons' Co., 1024 N. 61 St., Omaha, Neb. Estimated cost \$1,200,000,000
- Pa., Bridgeport—Darang Paper Co., Bridgeport, will construct a 1 story plant addition by separate contracts. Estimated cost \$90,000
- Pa., Philadelphia—Gulf Oil Corp., 30th St. and Penrose Ave., has awarded the contract for design and construction of a crude oil refinery to Foster-Wheeler Corp., 165 Bway., New York. N. Y. Estimated cost \$10,000,000

- Tenn., Charleston—Bowater Southern Paper Corp., c/o Bowaters Newfoundland Pulp & Paper Mill, Ltd., Corner Brook, Newfoundland, Cam., has awarded the contract for a newsprint and sulphate pulp mill on Hiwassee River to Roane-Anderson Co., W Tyrone Rd., Oak Ridge, Tenn., Fraser-Brace & Co., 10 E 40th St., and Turner Construction Co., 430 Lexington Ave., both New York City. Estimated cost \$15,000,000. Total estimated cost \$50,000,000.
- Tenn., Chattanooga—Chattanooga Glass Co., 451 Oakland St., has awarded the contract for plant additions to John Martin Co., 610 W Manning St. Estimated cost \$100,000
- Tex., Big Spring—Reef Fields Gasoline Corp., 1533 Bissonnet St., Houston, and Skelly Oil Co., Tulsa, Okla, have awarded the contract for a natural gas plant to Delta Engineering Corp., 2121 San Felipe Rd., Houston. Estimated cost \$2,225,000
- Tex., Corpus Christi—Suntide Refining Co., c/o Sunray Oil Co., 1st Natl. Bank Bldg., has awarded the contract for a crude oil refinery to Lummus Co., 385 Madison Ave., New York, N. Y. Estimated cost \$14,000.000
- Tex., Dymas—Shamrock Oil & Gas Co., Natl. Bank Bldg., Houston, has awarded the contract for an alkylation plant to Gasoline Plant Construction Co., N Esperson Bldg., Houton. Estimated cost \$2,300,000
- Tex., Mt. Pleasant—American Liberty Oil Co., Mt. Pleasant and 40 Highland Park Shopping Village, Dallas, has awarded the contract for a gas production concentration unit and modification of existing polymerization unit also thermofore catalytic cracking unit to Fluor Corp., Ltd., M & M Bldg., Houston. Estimated cost \$1,430,500 and 698,200 respectively
- Va., Covington—West Virginia Pulp & Paper Co., Covington, has awarded the contract for plant additions to B. F. Parrott & Co., Boxley Bldg., Roanoke. Estimated cost \$100,000
- Va., Norfolk—Hampton Roads Paper Co., c/o W. A. Hall & Co., Monticello Arcade, contractor, will construct a warehouse. Estimated cost \$85,000
- Va., Portsmouth—Murro Chemical Co., c/o Portsmouth Chamber of Commerce, 510 Dinwiddie St., has awarded the contract for a 1 story factory to Portsmouth Industrial Foundation, 2401 Airline Blvd. Estimated cost \$100,000
- W. Va., Chester—Harker Pottery Co., Chester, has awarded the contract for a 1 story storage building to Byrum Construction Co., 12th and Water Sts., Wheeling, Estimated cost \$85,000



### through one-piece bonnet construction



The rugged, jointless, steel bonnet of the Honeywell Series 700 Valve affords greater strength, simpler disassembly for inspection and maintenance... has deep, integral stuffing box built to superior performance standards, top-and-bottom packed lantern gland to minimize leakage. The Honeywell Series 700 wide band proportioning valve comes in a full range of styles and sizes... has all the features you look for in a fine valve. Write today for your copy of Bulletin 700-3.

MINNEAPOLIS-HONEYWELL REGULATOR CO., Industrial Division, 1904 Windrim Ave., Philadelphia 44, Pa.

Honeywell



First in Controls

## an ideal team

to solve your motor starter problems in damp atmospheres and wet surroundings



Allen-Bradley Automatic
Starters are good for millions of
trouble free operations.
They require no contact maintenance—
a desirable feature in a botted enclosure.



 Allen-Bradley Watertight Enclosures protect men, motors, and machines in damp, wet atmospheres.



Wherever conditions are moist or wet . . . you run your plant with the first team when you install Allen-Bradley starters in watertight enclosures. Allen-Bradley starters are so dependable and trouble free. Furthermore, silver alloy contacts require no maintenance. These are important assets in starters used in bolted enclosures. The safe Allen-Bradley NEMA Type 4 enclosure fully protects men, motors, and machines in wet, moist surroundings. Specify Allen-Bradley controls.

Allen-Bradley Co. 1337 S. First St., Milwaukee 4, Wis.



### TYPICAL WATERTIGHT ENCLOSURE APPLICATIONS AT EMERY INDUSTRIES



Pumps in the Acid Boil Department equipped with Allen-Bradley Bulletin 709 Solenoid Starters in NEMA Type 4 Watertight Enclosures.



Water treatment process controlled by Allen-Bradley starters, selector switches, and push button stations . . . all in NEMA Type 4 Enclosures.

ALLEN-BRADLEY QUALITY MOTOR CONTROL



### Rotameters Offer Definite Advantages In Metering Fluid Rate of Flow

(On-The-Job Photos by Courtesy of Hoffmann-LaRoche, Inc., Nutley, N. J., Manufacturers of Pharmaceutical Chemicals and Vitamins)

In the modern plant of Hoffmann-LaRoche, Inc., in Nutley, N. J., SK Universal Rotameters are used in large numbers to measure fluid flow rates in the manufacture of pharmaceutical chemicals and vitamins.

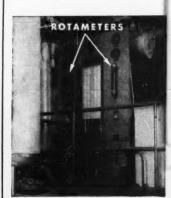
In metering rate of flow, Rotameters offer definite advantages. They are fast and accurate—are easy to read. Since they have only one moving part, the rotor, maintenance is very simple. Cleaning is easy and fast since the Rotameter can be dis-assembled without disturbing pipe connections. They are versatile in that they can be designed to meet varying requirements.

The SK Universal Rotameter is suitable for most applications, however, many other types are available. These other types include: Chemical, Armored, Flow Alarm, Electronic Recording, Pneumatic Recording, Laboratory, Bypass, and other Rotameters. Each type offers definite construction and operation features of value to anyone desiring to measure fluid rate of flow.

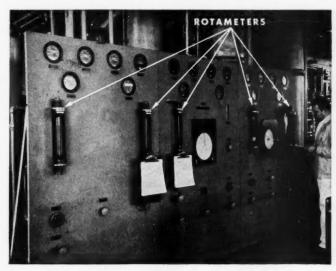
All types are based upon the same basic principles of operation. Fluid enters the tapered meter tube at the bottom and leaves at the top. The fluid exerts a force on the rotor which is proportional to the rate of flow and The SK ENGINEERING NEWS, published quarterly in magazine form, contains articles on principles and applications of equipment manufactured by Schutte and Koerting Company. We will gladly add your name to the NEWS' mailing list.

holds the rotor in a steady position in the tube for any rate of flow within the range of the meter. The rotor position in regard to the scale on the meter tube indicates the rate of flow.

Bulletin 18-RA pictures and briefly describes all types of SK Rotameters and lists, by number, the detailed bulletin relating to each. Request a copy.







CHEMICAL ENGINEERING—September 1952

### HEADING IN NEW DIRECTIONS\*

Pointing the way to the varied uses ... new and old , ...

of its products is an integral part of Niagara's service to industry.

### NIALK® Carbonate of Potash

This potash salt is now playing an important role in numerous pharmaceutical and vitamin applications, where its exceptional purity and quality make it particularly helpful in meeting the high manufacturing standards of the drug field:

Careful research, plus an alert awareness of industry's requirements, help to make NIALK products leaders in their fields.

### NIAGARA ALKALI COMPANY

60 East 42nd Street, New York 17, New York

\* NIACK LIQUID CHLORINE NIACK CAUSTIC POTASH

ALK CARBONATE OF POTASH NIALK PARADICHLOROBENZENE

WALK CAUSTIC SODA WALK THIS HIS Wethylene

MAGATHAL & ITETRACHLORO PHTHALIC ANHYDRIDE





and chose the

### **BRISTOL DYNAMASTER**

Continuous-balancing electronic recorder

The instrument makers whose advertisements appear above know that their reputations depend upon the accuracy and reliability of their recorders. They select each component part with scrupulous care.

As the recording unit in their instruments, they all selected Bristol's Dynamaster. When you choose the Dynamaster for your own measuring needs you are assured of the same accurate, precise instrumentation demanded by these instrument makers.

BRISTOL

THERE'S A DYNAMASTER FOR EVERY NEED

Available as a bridge or potentiometer, with strip or circular charts, Dynamasters can measure any variable that can be converted into changes in d-c voltage, d-c current, resistance, or capacitance.

Dynamasters are providing accurate, trouble-free measurement and automatic control of such quantities as temperature, pressure, pH, speed, voltage, power, current, smoke density, strain, and resistance.

FOR MORE INFORMATION on the uses of this versatile recorder, use the coupon to get Catalog No. P1245.

The dependable Juidepost of Industry
AUTOMATIC CONTROLLING, RECORDING AND TELEMETERING INSTRUMENTS

BEFORE / BUYING
CHECK BRISTOL

OF Bristol Road
Weterbury 20, Conn.

Please send catalog giving details of Dynamaster performance to:

NAME

TITLE

COMPANY

ADDRESS

CITY

ZONF

STATE

revolutionary new KEY-KAST alloy welding fittings. assure longer life for piping systems!

1. Greater wall thickness throughout-for increased structural strength.

2. Extra thickness in critical areas —for greater allowance against corrosion and erosion.

> Check these KEY-KAST features against YOUR alloy welding fitting needs!

Available in low and intermediate alloys and various stainless steels.

Controlled quality . . . through rigid metallurgical control. Produced, inthrough rigid spected and tested in one plant.

Meets A.S.M.E., A.S.T.M., and A.S.A.

PROMPT DELIVERIES! Wire or write for information today

manufacturers and developers of products for high temperatures and pressures

P. O. BOX494-BEAST ST. LOUIS, ILLINOIS

DISTRICT OFFICES: MEW YORK . MEVELAND



## Manifold Control-the SAFE, SURE NORDSTROM WAY

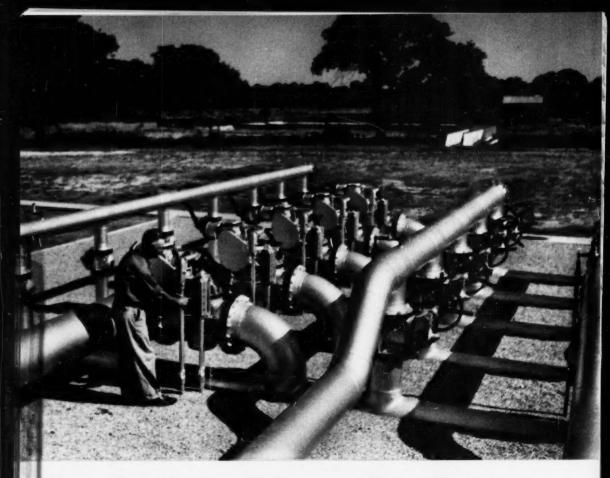
Often, in a single manifold, Nordstrom valves will be used to control several forms of gas, a variety of petroleum derivatives, or a diversified group of hard-to-hold chemicals.

Because of their versatility . . . because they are available in so many different metals, sizes, pressure classes and styles . . . because they are doubled-sealed with lubricants especially compounded for specific services . . . because

they open and close on a quarter-turn—these are among the reasons Nordstroms are ideal for manifold service.

In your control manifolds—consider the advantages of specifying Nordstrom lubricant-sealed valves throughout.





## How To Save Money On Valves

These installations are illustrations of the best way to save money on valves: specify Nordstroms in the first place. In original cost, Nordstrom valves often cost no more; over the life of the line or the equipment they serve, they almost always cost much less.

Nordstroms, the original lubricated plug valves, have proved their economy through 30 years of hard service in several thousands of different types of processes in gas, petroleum, chemical and other technological industries. That experience, that performance, is your reference. Nordstrom Valves are built by the Rockwell

Manufacturing Company, 400 N. Lexington Ave., Pittsburgh 8, Pa.



Another Product Nordstrom Valves

ALED TO KEEP UPKEEP DOWN



## This Guy Rates Our Finest!



Chances are you've never seen the product we make for this young man.

In a way, it's as important as the atom bomb.

It could mean his life to him.

We fervently hope he never has to use it.

The product is Pittsburgh Activated Carbon, an amazing, coal-derived adsorbent . . . the working heart of his gas mask. Every pound of these tiny black particles contains 125 acres of adsorbent surface. They are so efficient that Pittsburgh sup-

plied over 70% of all the carbon used in gas masks by our military in World War II.

Today, industry is making growing use of Pittsburgh Activated Carbons, in filtration, recovery, purification and refining of liquids and gases. They do the job better, faster and at lower cost than any similar material.

Right now, the demand for these carbons exceeds the supply. We're rapidly increasing our capacity, however, and are anxious to help you plan their future application in your plant... and to supply you with technical data and samples.

### GRANULAR CARBONS FOR

Solvent Recovery • Corn Sugar Refining
Catalysis • Water Conditioning
Gas or Liquid Purification • Air Conditioning

PULVERIZED CARBONS FOR

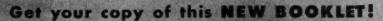
General Purification, Refining and Isolation

PITTSBURGH COKE & CHEMICAL CO.

COAL CHEMICALS . AGRICULTURAL CHEMICALS . PROTECTIVE COATINGS . PLASTICIZERS . ACTIVATED CARBON . COKE . CEMENT . PIG IRON

CHEMICAL ENGINEERING—September 1952

377



ON THE FUNDAMENTALS. CIRCULATING AND PHYSICAL FACTORS OF

## STRUTHERS WELLS

FOR QUICK AND THOROUGH DISPERSION OF LIQUIDS . GASES AND SOLIDS



This new Struthers Wells booklet illustrates and describes in detail—the fundamentals of four types of liquid agitation: 1. Propeller, 2. Open Impeller, 3. Shrouded Turbine, 4. Radial Propeller. The booklet presents technical data, photos, dimensional drawings and size details on a variety of pressure vessels in which agitators are used.

Included in the brochure are Marine Propeller Agitators, Radial Propeller Agitators, Agitator Drives and an advanced Agitator Design for quick dispersion of liquids, gases and solids. Mixing equipment is shown, for solids, semi-solids, pastes and liquids. Also, drawings and data are included on custom-made pressure vessels made to standard design.

Copies of this booklet—No. 58W —are free upon request. Use your letterhead, please.

WRITE TODAY



Struthers Wells Corporation

PROCESS EQUIPMENT DIVISION . WARREN, PA.

Plants at Warren, Pa. and Titusville, Pa.



SUBMERGED OILLESS BEARINGS



- OPERATE DRY or SUBMERGED IN DYES, PLATING, CLEANING & CHEMICAL SOLUTIONS, GASOLINE, FOODSTUFFS
- TRULY OILLESS AND SELF-LUBRICATING
- . EXTREMELY DURABLE
- CONSTANT COEFFICIENT OF FRICTION
- APPLICABLE OVER A WIDE TEMPERATURE RANGE even where oil solidifies or carbonizes.
- EXTENSIVELY USED IN CON-VEYORS, PUMPS & OVENS
- ROTATING SEALS OF GRAPHALLOY ARE UNEXCELLED

GRAPHITE METALLIZING CORPORATION

1024 NEPPERHAN AVENUE, YONKERS 3, NEW YORK

## Power Control and Transmission Problems?



### USE STEAMS, MAGNETIC CLUTCHES

If you have a problem of controlling machine operations and the source of power, be sure to investigate STEARNS Magnetic Clutches and Clutch-Brakes. Automatically controlled, they provide fast and smooth acceleration and disengagement. Having low inertia, they may be applied to a wide variety of jobs and are easily adapted to your machine requirements.

STEARNS Magnetic Clutches are simple friction devices, magnetically actuated, for split-shaft or through-shaft application. They are available in a number of styles and sizes ranging in torque from .4 lb. ft. to 30,000 lb. ft. STEARNS Magnetic Clutch-Brakes, a combination of a magnetic clutch and a spring-set magnetic brake, provide positive engagement, fast stopping, safe holding.



ST Comm	Foremost in the Magnetic Fie
	CHARLES WASHING
	629 S. 28TH STREET, MILWAUKEE 46, WISCONSIN
Please send m	ne literature on standard clutches.
	ne literature on standard clutches. presentative call — I have a special problem on 🗌 clutches 🔲 brak
Have your res	
Have your rep	presentative call — I have a special problem on 🗌 clutches 🗎 brak
Have your rep Please quote	presentative call — I have a special problem on 🗌 clutches 🗎 brak
Have your res	presentative call — I have a special problem on 🗌 clutches 🔲 brai



The productive life of costly equipment often can be lengthened through the installation of saran rubber tank lining. Saran rubber's high degree of chemical and abrasive resistance makes it an effective lining wherever the corrosive inroads of grease, many solvents, acids and other chemicals should be checked.

Saran rubber tank lining helps bring lower operating costs to industries handling, storing or transporting corrosives. The lining can be applied easily and economically by experienced applicators located strategically throughout the country. Get in touch with an applicator today by contacting your nearest Saran Lined Pipe Company office.

### Write to the Distributor: SARAN LINED PIPE COMPANY

2415 BURDETTE AVENUE • FERNDALE, MICHIGAN Offices in: New York • Boston • Pittsburgh • Tulse • Philadelphia Chicago • Portland • Indianapolis • San Francisco • Houston • Denver Los Angeles • Seattle • Cleveland • Charleston, S.C. • Toronto • Montreal



for tank cars
storage tanks • tank trailers
processing tanks
production tanks

#### RELATED PRODUCTS

Saran rubber molded parts—stoppers, diaphragms, various-sized moldings for valves, instruments, etc.

Saran lined steel pipe—corrosionresistant pipe that gives longterm operation with minimum maintenance costs.





HERE is a special line of gages that weld right to the liquid containing structure, thus becoming an integral part of it. It solves problems where it is impractical for you to use a conventional type gage because of solids in suspension in a liquid, etc.

These Special Gages follow Jerguson Standard Gages in general design and materials, except for the method of attaching. The chamber of the gage consists of a bar steel pad which is welded to the vessel.

Welding Pad Gages are made in both Reflex and Transparent types ... in all sizes of Jerguson Standard Gages. Pressure ratings are available to your specific requirements. Welding pad may be of any metal desired to withstand corrosive or other conditions.

Write for Data Unit on Welding Pad Gages for complete details. Whatever your gage problems, let Jerguson engineers assist you.



Saran Lined Pipe Company

2415 Burdette Avenue, Ferndale, Michigan

Please send me your catalog on Saran Rubber Tank Lining and Saran Rubber Molding Stocks.

Name\_\_\_\_\_Title\_\_\_\_

Address

City\_\_\_\_\_State



Alcoa Aluminum Heat Exchanger Tubes require far less cleaning than Admiralty tubes in furfural service. Aluminum does not catalytically polymerize furfural. Furfural does not corrode aluminum. In metal costs alone, aluminum costs ½ less than Admiralty, ½ less than mild steel, ½ as much as stainless.

These are actual costs reports from cleaning operations conducted by The Shell Oil Company at Martinez, California.

TEST	JUBE SIDE	اسما	AREA CSREARS FEET)	DAAS OUND Drifts   S		ALDON Spill backs Ex	MI POLICE	ESTIMATED SAVINGS (BOLLARS PER YEAR)
NO.			<b>E</b>		5 13		18	1,000
15	85 per cent oil, 15 per cent furfural, 305° F	300°.5			1	ESE ESE		800
16	85° per cent oil, 15 per cent furfural, 265° F	leffinate 320° f	225					
18	17 per cent oil, 3 per cent water, 80 per cent furfural, 315° F	Dry furtural A18 7	1,400		SELECTION OF THE PERSON OF THE	10	118	1,000

# ALCOA

knows most about the use and application of aluminum heat exchanger tubes. Alcoa pioneered the use of aluminum in heat exchanger tubes 43 years ago. Although their sale today is limited by government regulation, you will pract to

Tubes. Write:

Although their sale today is limited by government regulation, you will want to start planning with a copy of the booklet, Alcoa Aluminum Heat Exchanger

Tubes, Write:

ALUMINUM COMPANY OF AMERICA . 1860-J Gulf Building, Pittsburgh 19, Pa.

### OVER 6 MILLION FEET OF ALCOA TUBES ARE IN USE FOR APPLICATIONS LIKE THESE . .

#### PETROLEUM

Condensers handling hydrocarbon fractions from such processes as Thermal and Catalytic cracking, reforming, polymerizing, etc. Vapor recovery condensers

Lube oil coolers Natural gas compressor aftercoolers Recompressor aftercoolers

Hydrogen sulfide gas coolers Furfural condensers and heat exchangers Propane chilling
Wax sweaters

Lean oil—rich oil exchangers
Amine solution coolers
Glycol-amine heat exchangers

and reboilers Jacket water coolers

#### CHEMICAL

Butanol Ethanol Ethylene Glycol Glycerin Hydroabietyl Isopropanol Methanol

Phenoi Propylene Glycoi Acetaldehyde Formaldehyde

Furfural

Heptaldehyde Acetic acid Stearic, Palmitic, Maleic Oleic acids Butyric acid Ricinoleic acid Acetanilide Ammonia Hydrogen Cyanide

ALCOA

Nitric acid (concentrated) Pyridine Hydrogen Sulfide

Benzene Dichlorobenzene Gelatin

Hydrogen Peroxide Turpentine Xylens

Use Alcoa Alclad 35-H14 Heat Exchanger Tubes with fresh, brackish and salt-cooling waters



### More Sugar from the Cane

Over more than four centuries of production from cane, many mechanical improvements have been made in the sugar refining process. Some of the more perplexing chemical aspects of the problem are now being solved by Vanol.—trade name for "Virginia" Sodium Hydrosulphite.

"Virginia" Vanol successfully copes with the organic colloidal substances which contaminate the sugar solution. These colloids are very hard to handle—to filter, coagulate and remove. They congeal and form sticky, resinous massecuite on repeated boilings.

VIRGINIA

The proper use of Vanol ("Virginia" Na<sub>S</sub>2<sub>O</sub>1) makes the masseculte more filterable; the molasses separates more easily from the sugar crystals. Thus the molasses may be more completely discharged —more sugar extracted from a given amount of cane.

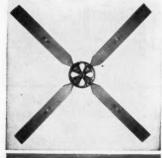
For over 30 years, "Virginia" research has been making significant advances in industrial processes and products with its SO<sub>2</sub>, NasS<sub>2</sub>O<sub>4</sub>, ZnS<sub>2</sub>O<sub>4</sub> and ZnSO<sub>4</sub>. Our technical staff will be glad to diginto your problems with a view to developing efficient, economical applications of "Virginia" Chemicals in your plant. Call or write us today, outlining your needs.

Plant. Call or write us today, outlining your needs.

VIRGINIA SMELTING COMPANY Box 21, West Norfolk, Virginia

VIRGINIA SMELTING COMPANY Box 21, West Norfolk, Virginia

## Need FANS?



MAIL COUPON NOW for detailed information on **Lenomasten** Industrial Cooling Fans

- FASTER COOLING
- LONGER LIFE
- GREATER ECONOMY
- FAST SERVICE

Koppers Aeromaster Fans are an adaptation of high-speed, top-efficiency aircraft propellers, resulting in longer life and improved anti-flutter performance. Aeromaster's high efficiency cuts power costs up to 10% . . . helps fan pay for itself.

Aeromaster Fans are available for every sizable industrial cooling requirement. Standard models range from 5 to 24 feet diameter, with 4, 6 or 8 blades, and in capacities up to 750,000 c.f.m. Easily assembled by unskilled labor. Engineering service furnished for special low-pressure propeller fan installations.

Every Aeromaster Fan is fully guaranteed by Koppers Company, Inc. Sales engineers available in all principal U. S. cities, as well as in Europe.



Field Offices

BOSTON DETROIT

CHICAGO PHILADELPHIA ATLANTA

## Ceramics and Man through the Ages





First people in Western Asia to develop a civilization superior to the Neolithic were the Sumerians, later called Babylonians. Absence of stone in the Tigris-Euphrates valleys forced these builders to turn to sun-dried or kiln-dried bricks, of which the first reference is found in Genesis xi, 3:

"And they said one to another, Go to, let us make brick, and burn them thoroughly. And they had brick for stone, and slime had they for mortar."

One of man's earliest inventions, the brick has descended with various modifications from the building of the Tower of Babel to its multiple present day uses such as refractory brick.

We don't make refractory brick, but we do produce the ALCOA Alumina that gives these refractories: Additional strength under load at high temperatures...lower coefficient of expansion...higher resistance to spalling and cracking...chemical inertness... negligible porosity and shrinkage.

ALCOA Alumina also improves glass, chinaware, glazes, tile and electrical insulators. And remember—the higher the alumina content, the better the performance and the longer the life of any ceramic product.

If you are interested in *better* refractories, let us prove what ALCOA Alumina can do. Aluminum Company of America, Chemicals Division, 602-j Gulf Building, Pittsburgh 19, Pa.

**FREE**—For a free chemical analysis of Babylonian bricks, write to Alcoa on your company letterhead.

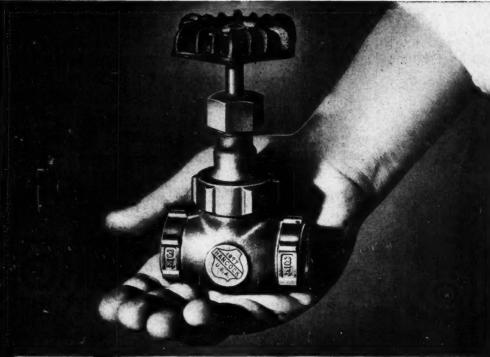
Alcoa Chemical



ALUMINAS and FLUORIDES

ACTIVATED ALUMINAS - CALCINED ALUMINAS - NYDRATED ALUMINAS - TABULAR ALUMINAS - LOW SODA ALUMINAS ALUMINUM FLUORIDE - SODIUM FLUORIDE - SODIUM ACID FLUORIDE - FALIDIDORIC ACID - CRYGLIET - GALLIUM

Inscribed bricks of Ur-Ninmar, from Tell Asmar, Iraq. ca. 1925 B. C Courtesy of the Oriental Institute of the University of Chicago.





Usual Bronze Valve Diaphragm Construction



Hancock Bronze Valve Diaphragm Construction . . . 25% to 230% Stronger

## EXTRA-TOUGH BRONZE VALVES

FOR LEAK-PROOF SERVICE!

When you buy bronze valves, get what you want – greatest efficiency, longest service, biggest savings. Extra-tough Hancock Bronze Valves assure all  $th\tau ee$  with features like these:

- "500 Brinell" Stainless Steel Plug Seat and Disc prevent leaks.
- ✓ 125% to 230% Stronger Diaphragm than ordinary bronze valves.
- ✓ Hard-Rolled Bronze Stem (Acme threads) takes the roughest treatment.
- ✓ Long-Lasting, Seal-Tight Packing cuts maintenance.
- Real Back Seating makes packing easy under pressure. Direct seat between stem and bonnet—away from heat and flow of pressure media.
- ✓ Rigid Body, Bonnet and Bonnet Ring
  of durable steam bronze withstand
  installation and service abuse.
- Cool, Comfortable Handwheel built to operator specifications.

Durable Hancock Bronze Valves are made in sizes from 4" through 2" – globe and angle types, screwed ends—for 150#, 200# and 300# W.S.P. ratings. Phone your nearby Hancock Distributor for prompt delivery. Remember, Hancocks cost no more than ordinary bronze valves.

When Hancocks go in, valve costs go down.





A product of MANNING, MAXWELL & MOORE, INC. WATERTOWN 72, MASSACHUSETTS

MAKERS OF "HANCOCK" VALVES, "ASHCROFT GAUGES, "CONSOLIDATED" SAFETY AND RELIEF VALVES, AMERICAN" INDUSTRIAL INSTRUMENTS. BUILDERS OF "SHAW-BOX" CRANES, "BUDGIT" AND "LOAD LIFTER" HOISTS AND OTHER LIFTING SPECIALTIES.



### SAVES YOU DAYS

WHEN YOU WANT



When you need hand and bench tools now, delivery next month won't help much! To give you service now-as well as to help you with your year-around tool

problems-Snap-on's 42 factory branch warehouses listed here put a selection of more than 4,000 tools at your elbow. The Snap-on branch near you is staffed with tool specialists-men who know how to help you save production and maintenance time and increase safety by using the right tools. Let us send you copies of the latest Snap-on Industrial and General Catalogs.



CHEMICAL ENGINEERING—September 1952

SNAP-ON SERVES INDUSTRY EVERYWHERE THROUGH THESE 42 FACTORY BRANCH WAREHOUSES

Albany 5, N. Y., 546 Clinton Ave. Atlanta Ga., 380 Techwood Drive, N.W. Baltimore 18, Md., 1209 E. 25th St. Boston 35, Mass., 116 N. Beacon St. Brooklyn 25, N. Y., 1649 Bedford Ave. Buffalo 13, N. Y., 628 W. Utica St. Charlotte 6, N. C., 915 S. Clarkson St. Chicago 16, III., 2023 Michigan Ave. Cincinnati 6, Ohio, 605 E. McMillen St. Cleveland 15, Ohio, 2912 Euclid Ave. Dallas 1, Texas, 2932 Commerce St. Denver 3, Colo., 1050 Broadway Detroit 2, Mich., 93 Piquette Ave. Fargo, N. Dak., 421 N. P. Ave. Houston 3, Texas, 1810 LaBranch St. Indianapolis 2, Ind., 848 Fort Wayne Ave. Jacksonville 6, Fla., 1602 Walnut St. Kansas City 2, Mo., 3635 Main St. Los Angeles 14, Calif., 1717 W. 6th St. Milwaukee 3, Wis., 2600 W. State St. Minneapolis 3, Minn., 1218 Harmon Place Newark 6. N. J., 823 Sandford Ave New Orleans 13, La., 1040 Camp St. New York 56, N. Y., 397 East 167th St. Oklahoma City 3, Okla., 901 N. Hudson Omaha 2, Nebr., 109 S. 24th St. Philadelphia 30, Pa., 1710 Fairmount Ave. Pittsburgh 8, Pa., 7007 Kelly St.
Richmond 20, Va., 1617 West Broad St. San Francisco 2, Calif., 635 Golden Gate ttle 22, Wash., 1501 Olive Way St. Louis 3, Mo., 2647 Weshington Blvd. Syracuse 3, N. Y., 323 Irving Ave. Toledo 6, Ohio, 2932 Monroe St.

### IN CANADA

Edmonton, Alberta, 10232 103rd St. London, Ontario, 111 Mr. Pleasant Ave. n, N. B., 33 Mechanic St. Montreal 15, Que., 751 Jean Talon St. W. Regina, Sask., 2070 Albert St. Toronto 17, Ont., 130 Laird Drive Vancouver, B. C., 1043 Davie St. ipeg, Manitoba, 238 Garry St.

### SNAP-ON TOOLS CORPORATION

8020-8 28th Ave., Kenosha, Wis.



. . . because it dissolves and disperses 2 to 20 times faster — and in the same space ordinary mixers require! The secret: the Cowles impeller which operates at velocities up to 7,500 f.p.m.

The Cowles Dissolver saves not only time and labor, it improves your product and yield per batch as well. It's rugged, fast-loading, easy to maintain, performs tasks other mixers cannot.

THE FACTS Dissolver — send for a catalog today! And test to have a detailed test run on your materials.

The Coules Company

THE COWLES COMPANY, INC. 112 Trackside, Cayuga, N.Y.

Gentlemen: Please send me your latest Cowles Dissolver catalog.

NAWE	
COMPANY	
ADDRESS	

CITY AND STATE

## What it takes to make steam behave at 1450 psi and 1000° F!





Grinnell Company, Inc., Providence, Rhode Island . Coast-to-Coast Network of Branch Warehouses and Distributors

pipe and tube fittings \* welding fittings \* engineered pipe hangers and supports \* Thermolier unit heaters \* valves
Grinnell-Saunders diaphragm valves \* pipe \* prefabricated piping \* plumbing and heating specialties \* water works supplies
industrial supplies \* Grinnell automatic sprinkler fire protection systems \* Amco air conditioning systems



## of dow corning ANTIFOAM A"

↑ The housewife wants "oodles of rich suds" but the detergent manufacturer wants production economy. Alert processors get both with a pinch of Dow Corning Antifoam A. As little as 2 ppm controls foam in animal or vegetable oils, detergency unaffected.

That kind of performance is why you'll find that this remarkably effective silicone is the most economical defoamer you've ever used. Bland and non-inflammable, its high order of chemical and thermal stability prevents it from contaminating or reacting with most foaming media.

Easily dispersed in a wide variety of solvents, Antifoam A is effective in most aqueous foaming systems. Where solvents cannot be used, specify Antifoam A Emulsion. Containing 30% Antifoam A by weight, this stable, easily dispersed suspension may be introduced directly without the use of carrying agents.

Olf high production costs are pinching your profits, pinch them back with Antifoam A. Evaluation samples available upon request. Simply fill in and mail the coupon today.





# Crush 9t! Grind 9t Separate 9t



### HAMMER MILLS

For heavy duty crushing or grinding of virtually any mineral or chemical — Williams builds them to do a complete job in one operation! Primary and secondary crushers are unnecessary — extra foundations, conveyors, other equipment are eliminated! You can save up to 75% on initial investment — up to 50% on grinding costs with the right Williams Hammer Mill!

Do It Better,
Faster And At
Less Cost With...

## WILLIAMS



### **HELIX-SEAL HAMMER MILLS**

For cleaner, safer dustless grinding of dry materials—or non-clogging, accurate grinding of wet, sticky or greasy materials—to finenesses of 100 to 325 mesh. Combines the advantages of a hammer mill with closed-circuit screw-type feed. No separators, fans or cyclones required. Available with steam or water jackets. Low investment—inexpensive to install and operate.



### MILLS WITH AIR SEPARATION

For accurate, uniform pulverizing or blending. Instantly adjustable to finenesses down to 400 mesh, even micron sizes. Dries and grinds simultaneously. Automatic, self-adjusting feed. Many other exclusive engineering and construction features. Wills have set new standards for product quality, output and economy.

### OTHER WILLIAMS EQUIPMENT

IMPACT and DRIER MILLS
AIR SEPARATORS
VIBRATING SCREENS
COMPLETE "Packaged" PLANTS For
Installation In Existing Buildings

## At Your Service WILLIAMS TESTING LABORATORY

Consult Williams on any grinding, crushing, shredding or separation problem, no matter what the material. The most complete testing and research facilities are available without cost or obligation. Simply furnish enough raw material for a test run, and a sample or description of the finished product desired.

THE STATE OF THE PROPERTY OF T



OLDEST AND LARGEST MANUFACTURER OF HAMMER MILLS IN THE WORLD



### FINE OR COARSE MESH

More than 600 different mesh sizes are available from 20 x 250 mesh up to 4" openings. Many popular items are kept in stock and can be shipped to you immediately.

### ANY METAL OR ALLOY

Any metal or alloy that can be drawn into wire can be woven into wire cloth by our skilled craftsmen, including precious metals and unusual materials such as lead wire.

### VARIED WEAVES

Cambridge industrial wire cloth is regularly produced in nine basic weaves. Single intermediate crimp through twilled dutch filter cloth, each of which has certain advantages for specific uses.

### ACCURACY

You know the mesh count is right when you specify Cambridge. Every inch of cloth produced in our plant is carefully controlled by individual loom operators during weaving; each finished piece is again carefully inspected before shipping.

### AND, FOR EXPERT ADVICE

on any problem of filtration, screening, sizing or other wire cloth uses, you can count on your Cambridge field engineer to provide the answer. Call on him freely. For information, write direct or look under "Wire Cloth" in your classified telephone directory.

FREE wire cloth reference manual. Gives complete range of sizes and weaves available from Cambridge. Also specifications, metallurgical data and fabrication WRITE CODAY



### The Cambridge Wire Cloth Co. Dept. G • Cambridge 9, Md.

METAL S ECIAL
CONVEYOR METAL
BELTS FARRICATIONS

OFFICES IN PRINCIPAL INDUSTRIAL CITIES

## For industrial applications involving flammable fluids your surest protection is



Air foam is the most effective, most economical agent available for extinguishing flammable liquid fires... and the easiest to apply. Pyrene\* makes the most complete line of equipment for its application. Whatever the size or nature of your hazard, Pyrene can handle your needs. Pyrene Air Foam Equipment is flexible. Installation can be fixed or portable. And Pyrene Foam Compound is sparing of water—one gallon added to 20 gallons of water produces about 200 gallons of foam. Complete data available. Send for it today!



### PYRENE FOAM PLAYPIPES

Portable; easy for one man to carry and use. Quickly couples into standpipe hose. Makes foam wherever water pressure is 50 pounds or more. Four sizes, capacities 200 to 1,600 gallons of foam per minute.



### PYRENE SPRAY SYSTEMS

Large and small, manual and automatic. Proportioners mix foam and water in line leading from water source to foam-making spray nozzle. Gives complete protection to such hazards as machinery spaces, mixing tanks, loading platforms, etc.



### PYRENE STORAGE TANK SYSTEMS

Fixed systems specially designed to meet the fire protection requirements of your storage tanks. Simple, manual, one-man operation. Special connections provided for hooking in playpipes for smaller fires—spill fires, for example.

\*T.M. Reg. U.S. Pat. Off.

### PYRENE MANUFACTURING COMPANY

593 Belmont Avenue

Newark 8, New Jersey

Affiliated with C-O-Two Fire Equipment Co.



### NEWARK "End-Shak" TESTING SIEVE SHAKER



Here, in the Newark "End-Shāk" unit, you get proper sustained hand motion mechanically. You get the best motion without being subjected to any human variation or weakness. This sturdy testing machine holds up to 7 full height sieves or up to 13 half height sieves. It is designed for 8 inch diameter sieves. Standard ½ HP., 110-220 volt 60 cycle, 1750 rpm motor supplied. Special motor to order.

NEW ARK

We'll be glad to send you prices and descriptive literature. And if you will outline your testing requirements we'll be glad to suggest the proper sieve series to use.

Newark Wire Cloth

351 VERONA AVENUE . NEWARK 4, NEW JERSEY

Pillindelphin 3, Ponna. San Francisco, Calif. Chicago, III. Hew Orleans, La. Los Angeles, Calif. Neustan, Teast \$231 Windows Bidg. 3100 1930 St. 20 N. Warter Br. 520 Marilion Bidg. 1400 Sa. Alameda St. P. 6. Bas 1930

### 1

### STATISTICAL QUALITY CONTROL

Just Published - Second Edition

A practical treatment of the rapidly growing technique of statistical quality control for maintaining top-notch quality on the production line. Gless cost-cutting methods you can put to work in short time with a minimum of trouble and expense. Explicit directions are given for the use of the various techniques, many case-histories Illustrate control chart use, and handy tables supply valuable working data. By Eugene L. Grant, Prol. of Econ. of Ecor. Stanford Univ. 2nd Edition, 557 pp., 94 illus., 19 tables, 85.0

### 2

### INDUSTRIAL WASTE TREATMENT

Just Published!

A practical quide for plant owners, managers, and engineers concerned with the problem of dealing with industrial wastes. Covers the Important legal aspects of stream pollution, tells how to secure samples and data, and how to develop and test a method of treatment. Discusses factors of plant design and construction to minimize pollution, and the techniques of reclaiming bypreducts from industrial wastes. By E. B. Beaseliever, Chief Sanicary Engineer, International Sales, The Dorr Co., Engineers, 365 pp., 100 illus. 37.00



### UNIT PROCESSES IN ORGANIC SYNTHESIS

Covers the principles and practices of reactions in organic synthesis, recording their development in terms of undershing unit processes. Deals with nitration, amination by reduction, halogenation, suffonation, oxidation, budrolysis, etc.—astematically discussing the factors and fundamental principles concerned in each. Fully revised to keep pace with chemical and chemical engineering advances, the book gives increased attention to developments in kinetics and thermodynamics. Some of the new material is based on actual German factory operations. Ed.-in-Cheft, P. H. Grospin, Bu. of Agric. & Indus. Chem. U. S. Degt. of Agric., Washington, D. C. 4th Edition, 937 90., over 200 illus. and fables, \$42.50

### 4

### AIR POLLUTION

Proceedings of the United States Technical Conference on Air Pollution



A systematic presentation of useful information on air pellutien; its effect on human, plant, and animal life; the measures being taken to control it; and the legal and administrative problems which are being overcome connected with pollution prevention and control. Contains detailed analyses of different contaminatis; describes latest equipment used, etc. Sponsored by the interdent. Comm. on Air Pollution. Chairman: Louis C. McCabe, Chief, Office of Air and Stream Pollution. 847 pp., 285 illus., 85 1240e, \$12.50

### SEE THESE BOOKS 10 DAYS FREE

	aw-Hill B					
Send	me the be	ook(s)	checke	d bei	ow for	0 day
for h	ook(s)   ke	ep, Blu	a ferw c	ents	for deliv	erv. ac
retur	n unwanter	s book	(a) po:	tpaid	. (We	pay fo
deliv	ery if you privilege.	remit	with	this	свирот	; san
	Grant-ST		HAL 12	rv c	ONTRO	L \$6.3
	Besselievre					
	Grospins-					
	McCabe-					
[] 4·	McCane-A	in ru	LLUI	IUN .	12.00	
Prin	t)					
Name			*****			*****
Addn	NN					
City			Zone		State	
Comt	aby					
Comp	aus					
Posit	oti					E-9-5
		ffer app				

CHEMICAL ENGINEERING-May 1952

hementator

xidising with ezon

NEW PROCESS-Ozone is being used more and more in chemical processing to carry out difficult oxidaions. Not only is it used in the manufacture of cortisone, but Emery Industries, Inc., of Cincinnati will use ozone to oxidize oleic acid.

Emery has just been given the green light by the government to start construction of a new \$2 million plant. It will be the world's largest single installation for the production of ozone. The ozone will be used in a new process, the result of joint research by Emery and Welsbach Corp. of Philadelphia, for oxidation of oleic acid.

PRODUCTS-This new plant will greatly increase Emery's output of azeluic and pelargonic acids, the two products that result from the oxidation of oleic acid.

Emery is now the sole producer of these two acids.

Now, because of the efficiency of the new ozone process, larger volumes of these acids will be produced, and at lower cost. In fact, azelaic acid will be next to the cheapest higher molecular weight dibasic acid on the market today. Likewise, pelargonic acid will be the cheapest monobasic aliphatic acid of its type.

ADVANTAGES-In addition to its increased efficiency, the new ozone process has other advantages. It eliminates the corrosion problem encountered in the present chromic acid oxidation. It gives higher yields of purer products. It's more versatile. In fact, it's expected that Emery's new unit will be able to use a broader selection of raw materials; this will mean a greater variety of end products, especially as other uses of this unique oxidation process are developed.

MARKETS-Interest in this development is heightened by current investigations in the use of dibasic acids and their esters in synthetic lubricants for military and civilian uses. Such lubricants may consume much of the output of Emery's new plant.

Meantime, the use of azelaic acid in alkyds, as

well as in plasticizers for vinyls, cellulosics and synthetic rubbers, can be expected to expand as costs come down. The markets in alkyds and plasticizers have been proved in the years Emery has operated its chromic oxidation plant. Only limited availability and relatively high price have curbed expansion in these fields. Now it will be possible to get the low-temperature performance of many esters of azelaic acid even in relatively low-cost plastic materials.

Emery's research points to growing use of azelaic acid as a raw material for polyamides of the nylon type. In polyamides, azelaic promises superior water

resistance. Pelargonic acid already has important uses that will grow as more of it comes on the market at lower cost. For example, more pelargonic will be used in flotation -where it's highly efficient but has been too costly

Another possibility is increased use of pelargonic acid in perfumes and fine chemicals. Actually, the name "pelargonic" comes from a botanical term associated with geranium oil.

sources-Amid current world tension, it's reassuring to know that oleic acid, the raw material for production of azelaic and pelargonic acids by the new ozone process, comes from animal fats and tallows. These are available in the U.S., and are currently in surplus supply. On the other hand, the closest counterpart of azelaic acid, one of the products, is sebacic acid, which is derived from castor oil, an imported raw material.

PRODUCTION—Emery's new plant is expected to be in operation within less than a year. By mid-1953 it will certainly be turning out azelaic and pelargonic acids by the new ozone process.

Nothing more need be said about

WELSBACH OZONE . . . write now to

CH CORPORATION ZONE PROCESSES DIVISION

## Niagara's HYGROL DRIES AIR BEST

### with exact moisture content

- to control your product's quality
- b to prevent condensation on your product or material
- to prevent changes due to moist air in contact with your product
- > to protect your material from dampness
- ▶ to protect your processing of moisture-sensitive material
- ▶ to DRY your material or product
- ▶ to pack or store your product safe from moisture damage
- to get exact moisture control for the precise atmosphere condition you need
- b to provide precise atmospheric conditions for testing
- b to increase your air conditioning capacity
- to DRY large quantities of fresh air from outdoors

### The Niagara's Controlled Humidity Method using HYGROL moisture-absorbent liquid is

Best and most effective because . . . it removes moisture as a separate function from cooling or heating and so gives a precise result constantly and always. Niagara machines using liquid contact means of drying air have given over 20 years of service.

Most reliable because ... the absorbent is continuously reconcentrated automatically. No moisture-sensitive instruments are required to control your conditions.

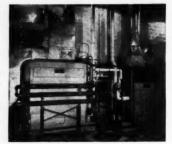
Most flexible because ... you can obtain any condition at will and hold it as long as you wish in either continuous production, testing or storage.

Easiest to take care of because . . . the apparatus is simple, parts are accessible, controls are trustworthy.

Most compact, taking less space for installation.

Inexpensive to operate because ... no re-heat is needed to obtain the relative humidity you wish in normal temperature ranges and frequently no refrigeration is used to remove moisture.

The cleanest because ... no solids, salts or solutions of solids are used and there are no corrosive or reactive substances.



### Niagara Controlled Humidity Air Conditioning

This method removes moisture from pir by contact with a liquid in a small spray chamber. The liquid spray contact temperature and the absorbent concentration, factors that are easily and positively controlled, determine exactly the amount of moisture remaining in the leaving air. Heating or cooling is done as a separate function.

For complete information write

### NIAGARA BLOWER COMPANY

Dept. CE, 405 Lexington Ave., New York 17, N.Y.

District Engineers in Principal Cities of United States and Canada

## REDUCE DOWN TIME WITH TEFLON

Today miracle Teflon\* is a proven product with a record of tough problems solved that is almost too good to believe. But the victories are true; Chemical and Power Products, Inc. has hundreds of actual case histories to back up that fact. Here is one:

One of the largest chemical processers in New Jersey turned to Teflon because, with ordinary packing, every machine in the plant was DOWN ONE DAY IN FOUR. The test set of Teflon packings used by this company was returned to us for inspection after ONE YEAR OF CONTINUOUS RUNNING and was found to be still in good working order. Today Teflon packings and gaskets are used throughout this plant.

Chemical and Power Products, Inc., makes a complete stock of Teflon in sheets, rods and tubes and tape form. Prompt delivery on O-Rings, Teflon or Kel-F, in all sizes is assured. Send for our illustrated booklet today to get the complete story of Teflon and Chemical and Power Products' services. Address Dept. CE9.

\*Teflon is du Pont's trademark for its tetrafluoroethylene resin.



## TO BE SURE!

No design, metallurgy or manufacturing procedures are taken for granted in

A. O. SMITH

Heat Exchangers.

It is characteristic of A. O. Smith engineering to question every step in the process of building heat exchangers and pressure vessels. Inspection and testing of the assembled unit is not enough.

Testing starts in our metallurgical laboratories to be sure materials satisfy fully the chemistry and physicals required to meet the specifications. Then, if necessary, we have complete facilities for testing the soundness of materials, with magnaflux, zyglo, dye check and reflectoscope.



Testing the end closure and channel of a heat exchanger at 4800 psi.
The closure is self-sealing, of modified Bridgeman type.

Welding electrodes and welding procedures to be employed are determined by our welding laboratories. Nothing is left to chance in this critical phase of production.

Statistical quality control procedures are employed to keep all manufacturing operations within the required tolerances.

And then, the engineering itself is tested during fabrication, as in the case illustrated. Components receive the most critical inspection and testing to be sure that the final assembled unit meets every specification exactly.

Combining the "know-how" of laboratory technicians, heat transfer and mechanical design engineers and production specialists at A. O. Smith assures maximum performance of every A. O. Smith vessel and heat exchanger.

A. O. Smith is regularly consulted on today's complex heat transfer problems. The personnel and facilities required to solve them are available to you.

INDUSTRY COMES TO A. O. SMITH WITH HEAT EXCHANGER PROBLEMS



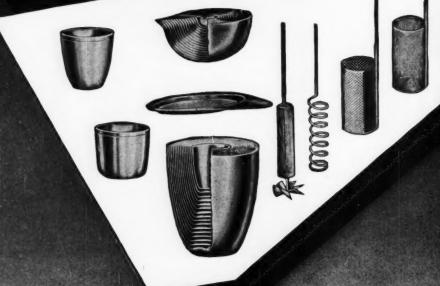
Research and Engineering Building

A.O.Smith

Chicage 4 • Cleveland 15 • Dallas 2 • Benver 2 • Houston: Los Angeles 22 • Midland 5, Toxas • New Orleans 12 New York 17 • Pittsburgh 19 • San Francisso 4 • Seattle 1 Tutes 3 • Washington 6, B.C.

International Division: P.O. Sox 2023, Milwaykee 1, Wis., U.S.A.

## Baker Platinum, Baker Platinum, Laboratory Ware



Production of platinum laboratory ware has been a specialty of ours for almost threequarters of a century, and we have devoted a great deal of research and experiment to improving it.

This work has been aided greatly by the fact that we maintain and operate large scientific laboratories and use our own platinum ware in them.

Thus, the ware is subjected to day in, day out tests through use, and practical experience has brought about a number of improvements, among which are:

Improvements in metallurgical processes which have increased its useful life — development of the platinum-rhodium alloy which is now so widely used — design changes like the reinforced rim on crucibles and dishes — development of the low form crucible — improvements in the design of platinum electrodes.

You run no risk in making Baker Platinum Laboratory Ware standard equipment.

BAKER & CO., INC.

113 Astor St., Newark 5, N. J.

NEW YORK

SAN FRANCISCO

CHICAGO

CHROMALOX gives you the LOW COST answer



### **CHROMALOX**

electric radiant heaters

Get all the advantages of infrared heat and more—at a fraction of former costs with the new and improved CHROMALOX heating principle. All-metal construction, high heat intensity, infrared radiation that's "color blind" and heat that's infinitely variable, have proved CHROMALOX Radiant Heaters superior for over 300 different uses in more than 1500 plants. If you use heat for baking, drying, preheating, curing, degreasing and similar applications, CHROMALOX Radiant Heaters can very likely give more satisfactory results. See for yourself how these infrared units up output, improve uniformity, reduce costs.

CHROMALOX

Electric Heat for Modern Industry

## Time, money and material saving applications

FOR MORE INFORMATION CHECK, CLIP AND MAIL COUPON

arming rying baking pans shydrating crackers sking biscuits shydrating coconuts
ying baking pans hydrating crackers iking biscuits
shydrating crackers iking biscuits
iking biscuits
shydrating caconuts
XTILES
hydrating braided
material
ying Nylon thread hydrating woolen cloth
tting flock
BBER
ring
rating rubber glue
ring latex
and iniex
INTING
10-1
drying
atic elimination
ue drying
ying varnished paper
paper k screen drying
n screen arying
RAMICS
. 12
ying frit
ying glaze
ying pottery
SCELLANEOUS
aling storage
batteries
ting adhesives and cements
ing tobacco
Iting wax
ring photographic
regatives and prin
hydrating kraft paper
lications
liant Heater Divisio
Itsburgh 8, Pa

## HORTON STAINLESS STEEL TANKS

for Boiling Nitro-Cellulose

The illustrations below show some of the 18 fielderected solid stainless steel tanks we built for boiling nitro-cellulose. They are flat bottom structures 18 ft. in diameter by 12 ft. deep and have extra false bottoms supported by stainless castings.

The shells and bottoms are made of Type 347 stainless steel and the tops of Type 321 stainless steel. The false bottoms and supporting castings are Type 304 stainless steel.

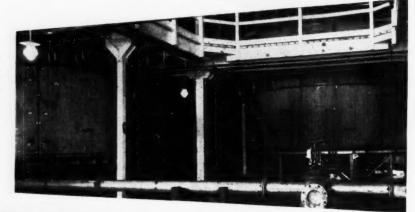
The 18 tanks rest on grillages made up of 4 inch channels on 14 inch centers, supported on trusses of

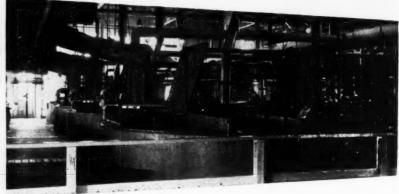
Type A-238 carbon steel. The tanks are arranged in two rows with a wooden operating floor approximately 4 ft. below their tops.

Chicago Bridge and Iron Company builds many types of structures for chemical storage and processing. In addition to solid stainless steel structures, we are equipped to fabricate and erect tanks and processing equipment of carbon steel clad with stainless steel or other corrosion resistant metals.

Write our nearest office for further information. There is no obligation on your part.

Right: Stainless steel tanks fabricated by Chicago Bridge and Iron Company for boiling nitro-cellulose. This view shows portions of the shells located below the operating floor.





Left: Another view of some of the 18 field-erected stainless steel tanks for boiling nitro-cellulose, showing portions of the shells above operating floor. Structures are all 18 ft. in diam. by 12 ft. deep.

### CHICAGO BRIDGE & IRON COMPANY

Atlants 3. 2120 Healey Bldg. Detroit 26. 1503 Lafayette Bldg. Birmingham 1. 1510 North Fiftieth 5t. Havana 4.02 Aubrey Bldg. San Francisco 4. 1522—200 Burh St. Destroit 10. 1005-201 Devronshire 5t. Houston 2. 2103 C & Bldg. San Francisco 4. 1522—200 Burh St. Chicago 4. 2124 McCormick Bldg. Los Angeles 17. 1505 General Petroleum Bldg. Tules 3. 1623 Hunt Bldg. Cleveland 15. 2220 Guildholl Bldg. New York 6. 3318—165 Broowy Bldg. Washingten, D. C. 1160 Cafritz Bldg. Plants in BIRMINGHAM, CHICAGO, SALT LAKE CITY and GREENVILLE, PENNSYLVANIA



# You Can Clean <u>This</u> Fluid Strainer <u>Without</u> Stopping the Flow

Cuno AUTO-KLEAN is the only fluid strainer with "combaction cleaning" which permits it to work uninterruptedly. Dirt accumulations are dislodged while the straining goes on. This can be done automatically. Guaranteed to remove 100% of all solids larger than specified.



Removes More Sizes of Solids from More Kinds of Fluids

Strain fuels, lubricants, process fluids, etc.—AUTO-KLEAN Filter fuels, lubricants, process fluids, etc.—MICRO-KLEAN Clean raw water, recirculating water, etc.—FLO-KLEAN

Fluid Conditioning

CHEMICAL ENGINEERING—September 1952

# "Non-Stop" Fluid Cleaning Saves Time, Protects Quality

Many chemical plants have welcomed the Cuno AUTO-KLEAN strainer as a means of eliminating the problem of periodically cleaning or replacing a fluid cleaner.

The AUTO-KLEAN does not have to be dismounted or taken apart for cleaning, and it has no replaceable element. Hence, no need to shut down the equipment, no risk of exposing the product to contamination or the operator to harmful fluids or fumes.

The Cuno AUTO-KLEAN is continuously cleanable. The rotation of its all-metal discs against cleaner blades combs out accumulated solids which fall to the bottom for removal whenever convenient.

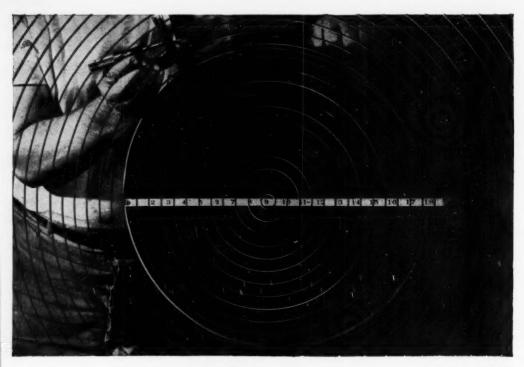
Never does process have to halt for sake of the strainer.

#### Many Metals Available

Cuno AUTO-KLEAN can be made in a wide range of materials to handle a wide range of fluids, viscosities, temperatures and solids. It is 100% permanent. The element is non-collapsible. It will last as long as the equipment on which it is installed.

Models are available for straining from .0035 to .062 in. Sizes to handle from a few to more than 4000 gpm.

Cuno Engineering Corporation Dept. 103A, South Vine Street, Maridan, Conn
Please send information on Cuno AUTO-KLEAP
for
Name
Company
Address
CityZoneState
Please attach to business letterhead



from 1/8" to 40"00

WHEN YOU NEED STAINLESS STEEL TUBING

## TRENTWELD will meet your needs best









Name an industrial application that calls for stainless steel tubing — and the tubing to name is TRENTWELD. Available in diameters from ½" to 40" OD TRENTWELD presents a broad range of grades, gauges and finishes.

Study the product and the plant where it is produced and you find the reason for the steady increase in TRENTWELD usage. For TRENTWELD is made in a *tube* mill by *tube* experts who roll and weld stainless and high alloy tubing without added rod metal. This Trent method results in metal-lurgically correct tubing with a uniform section and uniform corrosion resistance.

No matter how specialized your tubing needs may be, you will find there's a TRENTWELD tubing to meet your most exacting requirements. To call in Trent is to put our experience at your disposal. Write us full details of your most pressing problem involving stainless or high alloy tubing.

#### STAINLESS STEEL TUBING

FRENT TUBE COMPANY, GENERAL SALES OFFICES, EAST TROY, WISCONSIN (Subsidiery of CRUCIBLE STEEL COMPANY OF AMERICA)

# low cost heavy duty service with Foote Bros. WER

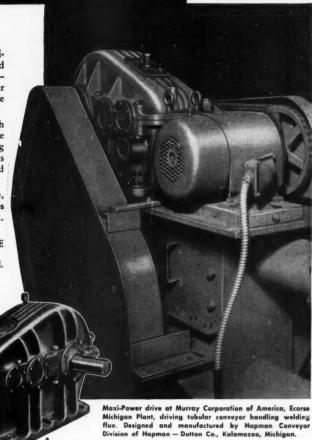
Costs go down when Foote Bros. Maxi-Power drives are installed! These rugged helical gear drives assure high efficiency low maintenance costs—operate day after day, year in and year out without trouble and with minimum maintenance.

Precision-Generated Helical Gearing with uniform load distribution across the entire face permits maximum load carrying capacity in minimum space and assures the maximum in reliable, uninterrupted performance.

These drives are available in single, double and triple reductions, with ratios ranging from 2.08 to 1, up to 360 to 1. Capacities up to 1550 h.p.

FOOTE BROS. GEAR AND MACHINE CORPORATION

4545 South Western Blvd. · Chicago 9, Ill.



FOTE BROS.



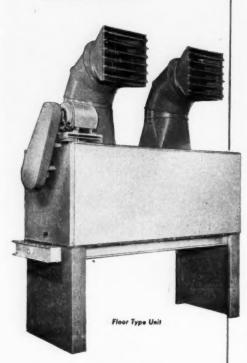
Foote Bros. Gear and Machine Corporation Dept. CE, 4545 S. Western Blvd., Chicago 9, Ill.

Please send Bulletin MPB containing full information on Maxi-Power Drives.

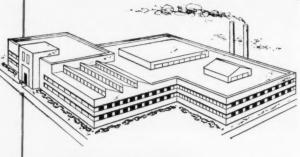
Name		,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	
Company			
Position	***************************************		
Address	······		
City		State	

Large area heating...

WITH OR WITHOUT DUCT-WORK



M. Quay



# M. Quay

**BLOWER-TYPE** 

# **Unit Heaters**

Where heat must be diffused over large open areas, as in warehouses, garages and industrial plants, the McQuay Blower-Type Unit Heater has a wide application. Available in floor, horizontal, vertical, wall and inverted styles in 8 sizes, up to 1,600,000 Btu. Only McQuay can give you famous Ripple-Fin coils—the construction feature that assures maximum heat transfer efficiency. Representatives in principal cities. Write McQuay Inc., 1622 Broadway Street N.E., Minneapolis 13, Minnesota.



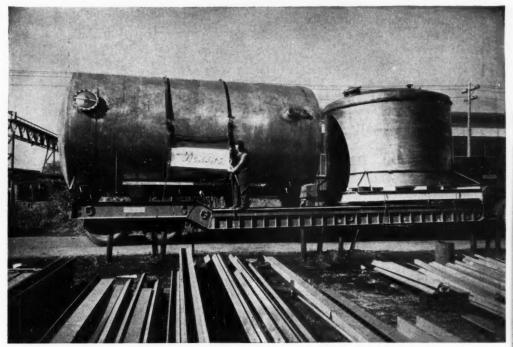
Harizantal Unit

HEATING AIR CONDITIONING REFRIGERATION



# COPPER

#### FOR CANADA'S LARGEST "SHOP-FAB" SCALE TANKS



to provide storage between alcohol produ**ction** and wooden barrel warehousing in one of Canada's largest distilleries.

#### COPPER STAYS CLEANER, IS NON-RUSTING, MORE ECONOMICAL TO FABRICATE AND USE

OUR NORTHERN NEIGHBOR does big things with copper-and demonstrates again its importance in food and beverage processing. These shiny-new tanks, for use in a distillery, were made by Canadian Vickers Limited, and are the largest copper scale tanks ever shop-fabricated in Canada.

Here the metal needed was a copper that would be suitable for welding. ANACONDA Deoxidized Copper-939 (3/16 of an inch thick) was chosen. It was tin-lined and easily oxyacetylene-welded with Anaconda Copper-372 Welding Rod.

The use of copper and its alloys is traditional in the food and beverage processing industries. Added economy, longer life and other advantages result from careful selection of the right alloys. Our Technical Department has extensive performance data on tap to guide you in making this selection. For your best source of copper and copper alloys, turn naturally to a company with over a century of experience-The American Brass Company, Waterbury 20, Connecticut. In Canada: Anaconda American Brass Ltd., New Toronto, Ontario. enno

FOR COPPER AND ITS ALLOYS . . . CONSULT ANACONDA

### DRAIN CORROSIVE WASTES

Safely, economically

## **PYREX** brand

"DOUBLE-TOUCH"

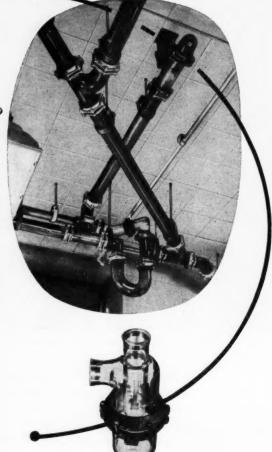
### **GLASS PIPE**

Now you can eliminate the costly down time and expensive replacement of corroded waste disposal piping, once and for all, with PYREX brand "Double-Tough" glass pipe. It is exceptionally resistant to all acids, except hydrofluoric, and also withstands the effects of mercury!

PYREX pipe users report phenomenal savings. One large user stated that his entire PYREX pipe installation paid for itself within nine months. Another reports: "We have been using PYREX pipelines to dispose of corrosive wastes for nearly three years. We have never had a maintenance problem-never even had to replace a gasket."

Transparency is another advantage. You can keep an eye on drainage. And the ultrasmooth surface of glass practically eliminates the adherence of solids.

What's more PYREX pipe is tough. It is highly resistant to physical and thermal shock. You can drain cold water immediately after hot acids. Available in diameters 1" to 6" with all standard fittings, plus sink traps, odd angle ells and laterals. Your nearest PYREX pipe distributor can give you complete information. Corning will gladly send you his name on request.



PYREX brand Sink Traps are nonsyphoning and permit easy cleaning. No plug to unscrew. Bulk of water remains in cap. Easily assembled with ordinary wrench.



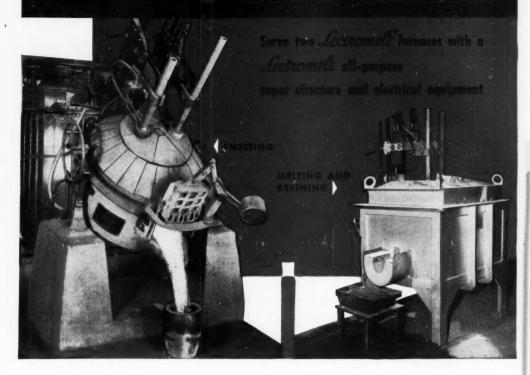
CORNING GLASS WORKS, CORNING, N. Y.

Corning means research in Glass

VISIT THE NEW CORNING GLASS CENTER



# Save money in outfitting your laboratory



With these two furnace shells and the one Lectromelt superstructure, your laboratory can handle almost any problem having to do with electric furnace operations. The superstructure can be shifted from one furnace to the other, as required, along with its electrical equipment.

The combination at the left is designed for small scale, batch smelting of ores and concentrates, melting of non-metallics, melting and refining of metallics. The furnace at the right can be used for continuous operations in experimenting on the

reduction of ores and melting of non-metallics.

Both furnaces can be employed with direct and indirect arcs. 50 KVA of power is available on low voltages and 100 KVA on high voltages.

Lectromelt engineers have been conducting continuing research for many years on electrothermic reductions, so they can help you put these laboratory furnaces to work proving new processes or improving the old ones. For Catalog No. 104 telling you about this service, write Pittsburgh Lectromelt Furnace Corp., 303 32nd Street, Pittsburgh 30, Pa.

Manufactured in . . . CANADA: Lectromelt Furnaces of Canada, Ltd., Toronto 2 . . . ENGLAND: Birlac, Ltd., Birmingham . . . AUSTRALIA: Birlec, Ltd., Sydney . . . FRANCE: Stein et Roubaix, Paris . . . BELGIUM: S. A. Belge Stein et Roubaix, Bressoux-Liege . . . SPAIN: General Electrica Espanola, Bilbae . . . ITALY: Forni Stein, Genoa.

REG. T. M. U. S. PAT. OFF

WHEN YOU MELT... Lectromelt



### The Right Formula for a 'Positive Reaction' in the Handling of Bulk Chemicals

#### **ELECTRIC VIBRATORS**



Make Stubborn Materials Flow Freely

#### FLAT PAN FEEDERS



Up To Hundreds of Tons Per Hour — Variable Control

#### TUBULAR FEEDERS



Feed Pure, Dusty, Poisonous Materials Safely

#### VIRRATING SCREENS



Wet or Dry—Single or Multiple Decks

#### HOPPER LEVEL SWITCHES



Maintain Desired Amount of Material In Bins, Hoppers

Fast, Economical Handling of Most All Chemical Products...Extremely Hot, Poisonous, Fine, Abrasive, Lumpy, Dry, Damp, Pure.

## SYNTRON

### MATERIALS HANDLING EQUIPMENT

 $\mathbf{S}_{\mathrm{material}}^{\mathrm{yntron}}$  Vibratory Equipment is easily adaptable to the many material handling applications found in chemical processing.

Electric Vibrators open up clogged bins, hoppers and chutes to free flow. Vibratory Feeders, equipped with a variety of troughs for different chemicals, feed from pounds to hundreds of tons per hour.

Vibrating Screens remove foreign objects and lumps from powdered chemicals—sizing chemicals in granule form.

Hopper Level Switches keep a constant level in hoppers handling dry

Hopper Level Switches keep a constant level in hoppers handling dry chemicals not exceeding nut size.

Syntron Vibratory Equipment handle these many different operations easily and efficiently. No motors, bearings, gears, cams, idlers, etc. to wear and require oiling. Simple electromagnetic vibration does the job. They are available in different sizes and styles, from small to large models.

Write Now for FREE Catalog of Syntron Equipment

SYNTRON COMPANY

610 Lexington Avenue

Homer C

Penna





...it makes good sense to sit down and study out all the economic advantages of salvaging, classifying, and up-grading dry industrial products with Sutton Gravity Separators and Air-Float Stoners. Upon request, you will immediately receive a list of 98 different mineral and industrial products, each representing a distinct separating problem solved by "offecting a difference in specific gravity through air-flotation." Chances are S & S Process answers your problem, too.

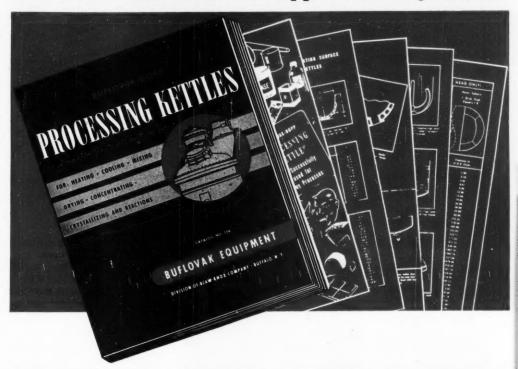
ADDRESS DEPT. "C"

SUTTON, STEELE & STEELE, INC.

SALES AND SERVICE: DALLAS - COLUMBUS, GA. - NEW YORK - PITTSBURGH - CHICAGO MINNEAPOLIS - LACESON, MICH: - DES MOINES - SAN FRANCISCO - TWIN FALLS, IDANO FOREIGE: WINNIPPE, CARADA - SAO PAULO, BRAZILI - LONDON, FINGLAND



# FREE!... A valuable 52-Page Catalog on the Modern Buflovak-Dopp Processing Kettles



# New and Useful Information on Heating..Concentrating ..Cooling..Mixing..Drying..Crystallizing..and Reaction

Modern BUFLOVAK-DOPP Processing Kettles are a vital part of many processes in the Chemical and Food industries. They successfully perform a number of basic operations; such as, heating, cooling, mixing, extracting, reacting, distilling, evaporating, drying, and solvent recovery.

Many operations can be progressively performed in the same unit; thereby speeding up production, lowering investment cost and increasing profits.

Other profit-building features are new and improved types of Agitators that give great savings in production time.

Whether you are in need of new equipment, or possible improvements in your present proc-

ess methods, you will find many helpful suggestions in this useful book.

#### BUFLOVAK EQUIPMENT

Division of Blaw-Knox Company

1551 FILLMORE AVE. . BUFFALO 11, N.Y.

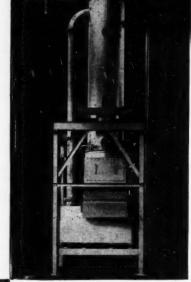
		(Comp	any Name)		
m/			(Title)		-
		me a free co ettle Catalog		BUFLOVAK-DO	OPI
Buffalo 11, N. Y.					
		ore Ave.			0.

\*
this machine
congeals,
molds and
discharges
automatically

"What is your processing problem?"



\*If your process involves a liquid that will solidify when cooled....
....this machine can do it....then discharge and size the substance.... all automatically



perhaps the Vogs automatic Tube-Type Molding Machine will provide the answer because it will form and size any liquid that will solidify when cooled, and will discharge by gravity upon heating.

Now in use by major chemical companies, these units have achieved tremendous savings in labor while producing a more uniform product. Also, since the process involves "freezing" or solidifying the substance while it circulates through tubes, the quality of the product is often superior to that of the original charge.

The wide range of uses to which Vogt Tube-Type Molding Machines have been adapted indicates their definite value in the chemical processing field. Adaptation possibilities are virtually unlimited and you may request detailed technical information from our engineers without obligation.



automatic Jube-Type

## MOLDING MACHINE

HENRY VOGT MACHINE CO., LOUISVILLE, KY.

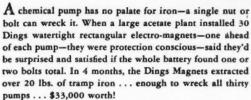
BRANCH OFFICES: New York, Philadelphia, Chicago, Cleveland, St. Leuis, Dallas, Charleston, W. Va.



## Threat to \$33,000 Removed by Dings Magnets

Acetate Plant Gets Surprise;

Unloads 20 lbs. of Iron



This plant achieved its objective to a degree beyond expectations. Three factors were responsible: (1) applying exactly the right magnet for the job; (2) the magnet itself was highly engineered and quality built; and (3) the magnet was correctly installed. Whatever your tramp iron problem, those are the things you buy when you buy a Dings "Job Selected" Magnet. Investigate today.

> **Dings Magnetic Separator Company** 4730 W. Electric Ave., Milwaukee 46, Wis. World's Largest Exclusive Builder of Magnetic Separators



THIS IS THE TYPE THAT DID THE JOB. The magnet that fit this job best is a Dings Rectangular (electro), a particularly versatile magnet which is effective at distances up to 18". Its triple pole design makes it effective on the most difficult jobs; fast moving conveyor belts, wet, sticky material, etc. Can be adapted in any number of ways to suit particular requirements. Catalog 301-A gives details.

This Catalog Helps You to "Job Select" a Magnet Is the material you want de-ironed solid . . . semisolid . . . liquid? Is it carried in chutes . . . ducts . . . conveyor belts? Catalog 5000-B lists Dings complete line by application, describes all Dings magnets from the low cost, non-electric "Perma

Plate magnet to the most power ful magnetic separators known. Send for it today.

#### MAGN





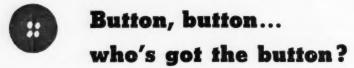














It's a great game for kids.

But it's no fun when you're installing a refrigerating machine.

You know what we mean. You order your refrigerating equipment here and there—from several manufacturers. And then it's "button, button...who's got the compressor?" And "button, button...who's got the cooler?"

One delayed part can hold up the whole job.

What you get from Carrier is a "refrigeration package"—complete in every detail. Heavy-duty reciprocating compressor, cooler, condenser, all interconnecting piping, fittings, safety controls, capacity controls, gauges ... everything ... ready to install.

And you get this: one manufacturer—Carrier—guarantees all components. So there'll be no "button, button...who's got the responsibility?" after the job is installed. You buy with peace of mind. And that's worth plenty!

The whole story is in our folder, "100 and 150 hp Reciprocating Refrigerating Machines." Write for your copy. Carrier Corporation, Syracuse, New York.





The packaged Carrier Reciprocating Refrigerating Machine is ideal for smaller applications or wherever reciprocating machinery would make the most economical installation. 100 and 150 ton range.

by-product with a big dividend

recovered with

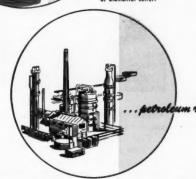
## FOSTER WHEELER EQUIPMENT

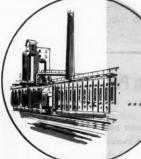
The unprecedented demand for Sulfur has reached a point where the world's available supply is seriously threatened. Thus, the need to find new sources for this vital element becomes one of the major items on today's agenda for full-scale production for both defense and civilian needs. refineries

Fortunately, there is a great new source. Instead of allowing it to vanish into thin air, Sulfur is being recovered profitably from H<sub>2</sub>S bearing gases with Foster Wheeler equipment. A quarter million tons of Sulfur per year will be recovered by Foster Wheeler

> plants installed or now under construction.

il and gas fields





FOSTER WHEELER

165 BROADWAY, NEW YORK 6, N. Y.

## **IDEA-PLASTICS**

.. from Du Pont Polychemicals Department

### "ALATHON"\*

## makes flexible pipe that's light in weight—resists chemicals—won't corrode

Many users of pipe can now profit two ways with pipe made from Du Pont "Alathon" polythene resin.

First, this pipe is quick, easy and economical to install because of the flexibility and light weight of "Alathon." Second, pipe made from "Alathon" is long-lasting because it won't rust, rot or corrode—is unaffected by acids, alkalis and most other chemicals. Also, because "Alathon" is odorless, tasteless and non-toxic, it is ideal for a variety of uses.

Pipe of "Alathon" is being used, for example: to carry water or corrosive fluids, gases, vapors and wastes in plants making paints, dyes or polishes—in coal, salt and other mines—in food processing plants—and for irrigation on farms and ranches.

The outstanding properties of Du Pont "Alathon" are being put to work, too, in flexible bottles, closures, coatings for paper, battery parts, insulation for wire and cable and other applications. Possible new uses



include shoe components, and binders for non-woven fabrics.

Your business, too, may find opportunities for profitable use in Du Pont "Alathon"—or in other Polychemicals products. There are more than 100 of them—amides, alcohols, ammonia, organic acids, resins, esters, solvents and plastics.

\*Reg. U. S. Pat. Off.

## Write for technical booklet on Polychemicals products for your industry

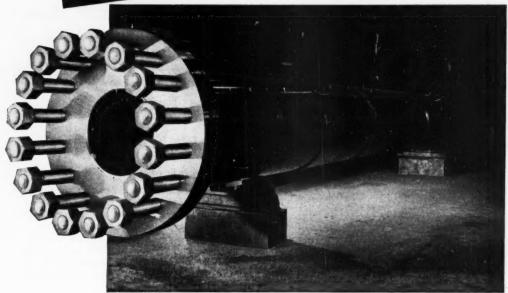
Technical bulletins on "Alathon" polythene resin and the chemicals and plastics used in your industry are available. Each product bulletin in the booklet presents physical and chemical properties, description, specifications, uses and possible applications, bibliography and other data. Write us on your business letterhead for your copy—and please tell us the type of application that you have in mind.

E. I. du Pont de Nemours & Co. (Inc.)
Polychemicals Department, 159E Nemours Building
Wilmington 98, Delaware



# What can we offer today





Now, as always, Bethlehem is prepared to build virtually any kind of forged vessel that meets your needs.

It can be of single-section or flanged multiple type. It can be furnished with almost any desired wall thickness. It can be large or small, and of special or conventional design.

A vessel built in our shops is an all-Bethlehem job, from the steelmaking to the final machining and testing. Its quality is protected by many important safeguards along the way, including, of course, a series of rigid and exhaustive metallurgical checks by our technical men. If you are planning to add new pressure vessels — now or in the near future—by all means talk with us. We are equipped to build the units you want, the way you want them.

#### BETHLEHEM STEEL COMPANY BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. Export Distributor: Bethlehem Steel Export Corporation





## FLON "rings First in preference in leading chemical plants everywhere! . Teflon "C-V" Rings withstand 1. Temperature from -94° F. to 482° F. 2. Any corrosive liquid or gas Why repack with ordinary materials when chemically inert "John Crane" Teflon "C-V" Rings can seal any corrosive liquid or gas and resist extreme temperatures? Also, they have extremely low friction characteristicswill not shrink, swell, harden, dissolve, corrode or deteriorate. Ideal for use on all valve stems and reciprocating pumps as well as many centrifugal and rotary pump applications. Cross-section design allows effective sealing at finger tight gland pressure. "John Crane" has developed a complete line of standard

finger tight gland pressure.

"John Crane" has developed a complete line of standard size Teflon "C-V" Rings and male and female adapter rings to meet practically every need. If you have special requirements, "John Crane" can mold additional sizes to fit your stuffing box requirements.

#### SEND FOR NEW CATALOG

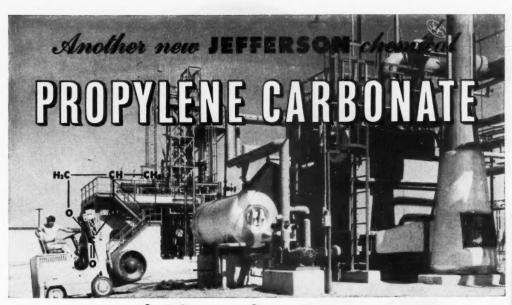
This illustrated booklet "The Best in Teflon", contains everything you want to know about the many kinds of Teflon products made by "John Crane". Write today for your free copy.





SOLID ASSEMBLY

SPRING ASSEMBLY



## now available in pilot-plant quantities

Properties of a typical sample of Jefferson's Propylene Carbonate are:

Boiling point, °C
Freezing point, °C
Flash point (open cup), °F
Refractive index at 20°C
Specific gravity, 20/4 °C
Appearance
Viscosity, centistokes
at -40°F
at 100°F

at 210°F

#### Suggested Applications:

hydraulic fluids solvent and selective solvent chemical intermediate hydroxypropylating agent 242 —49

270

1.4209

1.2057

Mobile water-white liquid

19.4

1.67

0.78

You may obtain technical information and experimental samples\* for research and development by writing to our Market Development Division, Dept. G.

### ★ Ethylene Carbonate samples and data are also available.

Essential Chemicals From Hydrocarbon Sources:

Ethylene Oxide Ethylene Glycol Ethylene Dichloride Diethylene Glycol Monoethanolamine Diethanolamine Triethanolamine Nonyl Phenol



260 MADISON AVENUE, NEW YORK 16, N. Y.

Houston Sales Office. 318 Metrose Building, Houston 2, Texas Warehouse Stores: Tenafly, New Jersey, Chicago, Illinois, Houston, Faxos





DEPENDABLE, WEATHERTIGHT STORAGE for 15,000 tons of sacked ammonium nitrate fertilizer is provided for chemical company by 12 Butler Buildings, Military, Kansas.

# For Warehousing or Plant Facilities Today Choose Butler Buildings



FULL SPACE USE is assured by Butler Buildings used as chemical processing plant at Memphis, Tennessee.

You can get new buildings quickly when you specify Butler Buildings (with galvanized or aluminum covering) . . . for plant expansion or new construction, for processing, packaging or storage facilities. And Butler Buildings offer these special advantages:

(1) Low cost . . . save up to 50% of the cost of building with commonly-used materials.

(2) Little maintenance.

(3) Permanent construction . . . built better to last longer.

(4) Fire-safe, weathertight, wind-resistant construction.

(5) Early occupancy . . . ready for use in days instead of weeks.

(6) Easy insulation . . . at low cost.

(7) Wide range of sizes.

Straight Sidewalls . . . Use All the Space You Pay For

Build today with Butler Steel Buildings. See your Butler dealer, or mail coupon below.



BUTLER MANUFACTURING
COMPANY
KANSAS CITY, MISSOURI

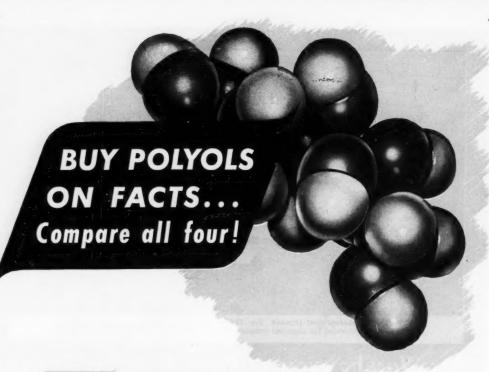
Galesburg, Illinois Richmond, California Birmingham, Alabama Minneapolis, Minnesota For prompt reply, address office nearest you: BUTLER MANUFACTURING COMPANY 7338 E. 13th St., Kansas City 3, Missouri 938A 6th Ave., S.E., Minneapolis 14, Minnesota Dept. 38A, Richmond, California

Send name of my nearest Butler dealer.

Send information about Butler Buildings, for use as\_\_\_\_

send information about Butler Buildings, for use as

Zone\_\_\_State\_\_



#### FACT: Sorbitol leads in chemical reactivity

A wide variety of useful compounds can be derived from sorbitol: anhydro sorbitols, polyoxyalkylene sorbitols, sorbitans, sorbides, organic and inorganic esters. This makes sorbitol not only valuable for conditioning or otherwise improving a wide variety of products, but important to the synthesis of resins, surface active agents, varnishes, and vitamin C.

#### FACT: Sorbitol leads in uniformity

Polyols made from a wide variety of raw materials are bound to vary widely from batch to batch. But sorbitol, made from sugar, *always* is uniform.

#### FACT: Sorbitol leads in economy and availability

On price stability alone, sorbitol rates the "best buy" in polyols. Its price trend through the years has been downward. What's more, because sorbitol is made from sugar, it is available in almost unlimited quantities.

Write today for the valuable 22-page Atlas sorbitol book containing charts, usage tables, and other helpful data. Personal technical assistance is available at your request.



**Industrial Chemicals Department** 

#### ATLAS POWDER COMPANY

WILMINGTON 99, DELAWARE . OFFICES IN PRINCIPAL CITIES
ATLAS POWDER COMPANY, CANADA, LTD., BRANTFORD, CANADA



CHAPMAN LIST

# for any number of different jobs



No other small valve has as big a field of application as this Chapman List 960 Forged Steel Gate Valve. You can get it is sizes from \(^1/4\)" to 2\(^1\), with joints either gasketed or metal... and in 2 types: Rising stem with yoke, as shown

types: Rising stem with yoke, as shown at left... or rising stem with inside screw. Pressure ranges from 2,000 lbs. at 100° F, to 380 lbs. at 1,000° F. And on any job, Chapman's List 960 shows the same unmatched ability to take it... and stay with it. One good reason is that hard faced Stainless steel seat rings and 800 Brinell hardening of gate faces by the exclusive Malcomizing Process, provide maximum wearresisting and non-galling properties. And still another reason is that changes in design have made stem and wedge gate connections 50% stronger than they ever were before.

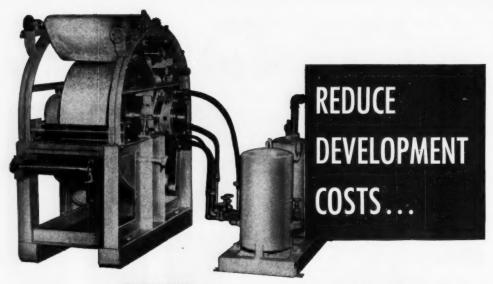
So if you want the biggest savings you ever got from a small valve, specify Chapman List 960.

THE

# CHAPMAN

VALVE MFG. CO.

INDIAN ORCHARD, MASS.



## **RENT** A FEINC PILOT PLANT FILTER

Here's a low-cost way to test FEinc's high performance for your process. This completely equipped small filter is just the thing for taking the "kinks" out of a process before scaling up . . . or for routine small-scale production.

FEinc's unique rental-purchase plan eliminates heavy capital expenses for experimental work. You simply pay a low monthly rental as you use the filter . . . and get a credit on the rent paid if you eventually buy any FEinc unit.

Fabricated of Type 316 stainless steel, the Pilot Plant Filter will handle almost any continuous filtration job. It has the famous FEinc String Discharge, Submergence Washing Mechanism, and Compression Dewatering Mechanism. Any of these features can be disconnected, and a scraper-type discharge is also furnished that can be attached with only four bolts.

IMMEDIATE DELIVERY! For the first time since they were introduced in 1949, these units are now available for immediate delivery. Write us today for more details!



STRING DISCHARGE



SCRAPER DISCHARGE



FILTRATION ENGINEERS, INC. 55 ORATON STREET . NEWARK 4, NEW JERSEY

#### VACUUM FILTER SPECIFICATIONS OF FEINC PILOT PLANT ROTARY

SIZE: 3 ft. drum dia., 1 ft. drum width. (Approx. 10 sq. ft. drum

CAKE THICKNESS: Handles cakes from 1/16" thick and up, including difficult slimes and fibrous materials.

WASHING: FEinc Submergence Washing Mechanism supplied, but can be disconnected if it is not necessary to your process.

**DEWATERING:** Normal, wide-arc vacuum dewatering supplemented by FEinc Compression Dewatering Mechanism that can be operated either as a part of or separately from the FEinc Washing Mechanism.

MATERIALS: Type 316 Stainless

FILTER DIMENSIONS: 4' long x 4'9" wide x 5' high.

CLOTH: Cotton, Nylon, Dynel, Orlon, Vinyon, Woven Wire, etc. as required.

VALVE: Automatic valve controls pickup, dewatering, washing. Quickly adjustable, easy to change over from one job to another.

INSTALLATION REQUIREMENTS: No foundation required. All major piping furnished, ready for connection to your vacuum source.

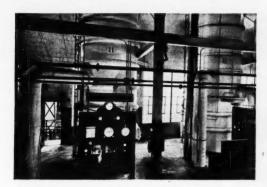
AGITATOR: Separately driven oscillating agitat

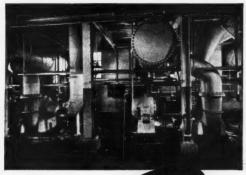
MOTOR DRIVES: Trouble-free, variable speed motor drive permits instant adjustment of drum speed to meet variations in filtering conditions. Agitator and filter motors each ¼ H.P., 1750 RPM, 220/440 v, 3 ph., 60 cyc., Class I, Group D.

SHIPPING WEIGHT: 2700 lbs. with accessories.

See
General American for
CREATIVE
EVAPORATOR
ENGINEERING

# engineers will modify tested basic designs to fit YOUR production!





Built to specialized designs for each specific application, General American Conkey evaporators are meeting flow sheet requirements in every branch of the chemical industry.

Conkey evaporator installations deliver a uniform product with virtually complete recovery of solids, at maximum economy—even when operated by unskilled labor.

Because evaporation is a unit operation, Conkey evaporating equipment is individually designed for specific operating conditions—to fulfill desired economy and performance requirements. Basic types of known characteristics and performance are modified in design and materials of construction to meet needs of your operation.

Because of the huge number of variables encountered, each evaporator problem *must* be treated individually. Conkey engineer specialists will help you meet the performance and economic requirements of competitive production in any field. For complete technical information, write for Evaporator Bulletin.

Designed to do your job best!

Other General American Equipment:

Turbo-Mixers, Filters, Dewaterers, Dryers, Towers, Tanks, Bins, Pressure Vessels

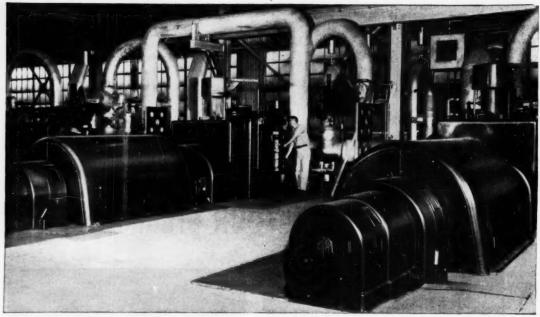
OFFICES IN ALL PRINCIPAL CITIES



Process Equipment Division
GENERAL AMERICAN
Transportation Corporation

Sales Office: 10 East 49th St., New York 17, N. Y. General Offices: 135 S. La Salle St., Chicago 90, Ill.

In Canada: Canadian Locemetive Company, Ltd., Kingston, Ontario



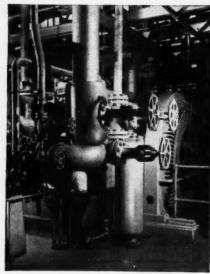
EXTRA POWER, EXTRA PROCESS STEAM is delivered by these 13,800-volt G-E turbine-generators. They utilize steam with high

efficiency. Together with other turbine-generators in the plant, they furnish the electric power and all of the plant's process steam.

# How alkali plant saves 2 ways



COMPACT, METAL-CLAD G-E SWITCHGEAR in power plant at Saltville was easy to install, has saved inspection and maintenance time.



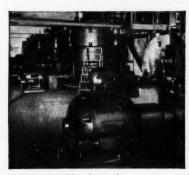
PEAK DRIVE EFFICIENCY in "dry-ice" building is provided by five 2300-v G-E synchronous motors that drive compressors.



TO REDUCE COST of feeders, transformers, and switchgear at Saltville, and to cut power losses, power is distributed at high voltage. Two of

the G-E unit substations in foreground step down 13,800 volts to 2300 volts for plant distribution.

# with high-voltage power system



**HEAVY DUTY** 75-hp Tri-Clad\* motors drive coal pulverizers. Typical of many such drives in the plant.

Registered trade-mark of General Electric Company

#### Mathieson's Saltville, Va. plant reduces line losses, cuts equipment costs with 13.8-ky power system

Each step in the electrical system of Mathieson's Saltville plant—generation and utilization—takes advantage of high-voltage power distribution.

Electricity generated by turbine-generators at 13,800 volts is distributed to the various utilization areas where it is stepped down in compact load-center unit substations. The need for long low-voltage feeders is ended. Voltage drop is lessened. Plant efficiency is increased. Installed cost

of the plant's electrical system is lower.

Integrating the Saltville plant's power system—planning it to function as one efficient unit—was the job of General Electric system engineers. They can provide the co-ordination you need for highest over-all electrical system performance. Contact your G-E Apparatus Sales representative early. General Electric Company, Schenectady 5, N. Y.

Engineered electrical systems for chemical plants

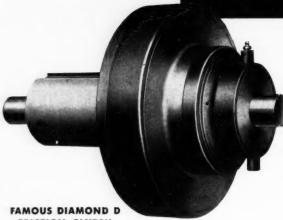
GENERAL EBECTRIC

ROLLING GRIP FRICTION CLUTCH "NO TOGGLES!" 1/3 to 21 H.P. CAPACITIES



# DODGE FRICTION CLUTCHES

Proved in thousands of industry's toughest jobs!



FRICTION CLUTCH CAPACITIES UP TO 470 H. P.!



Look to Dodge for the clutches to meet your specific needs. Dodge leadership in the field of mechanical power transmission is strikingly evidenced in the advanced design and engineering of a complete line of friction clutches, in a full range of sizes with capacities from 1/3 hp to 470 hp.

#### ROLLING GRIP FRICTION CLUTCH

New and simplified design gives new ease of control with positive drive and extreme ruggedness. There are no toggles! Instead the mechanism shifts smoothly on hardened steel balls-and has the positive grip of a wedge. (Operating parts enclosed for safety yet quickly accessible for service). Available from distributors' stocks in two types-Bolted Plate or Gear Tooth Mechanism in sizes from 1/3 hp to 21 hp at 100 rpm.

#### DIAMOND D FRICTION CLUTCH

Built with the stamina for grueling service, this rugged clutch has a world-wide reputation for dependability. It's compact, too-completely enclosed in both engaged and disengaged positions. Adjustment is simple-an Allen wrench at one point does the job. Available in single, double or triple friction plate design in several types of construction. Capacities from 21 hp to 470 hp at 100 rpm.

DODGE MANUFACTURING CORPORATION 200 Union Street, Mishawaka, Indiana

CALL THE TRANSMISSIONEER, your local Dodge Distributor. Factory trained by Dodge, he can give you valuable assistance on new cost-saving methods. Look for his name under "Power Transmission Equipment" in your classified phone book.









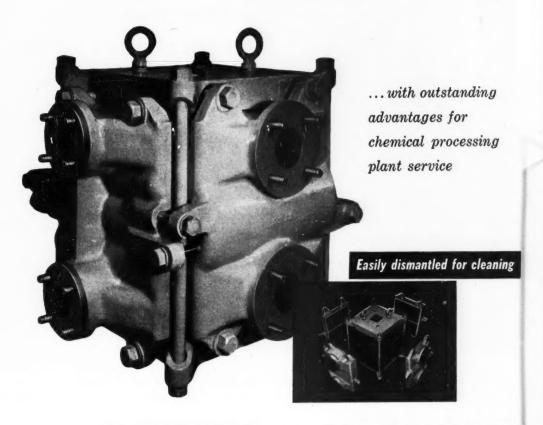


DODGE-TIMKEN PILLOW BLOCKS



FOR YOUR NAME PLATE REQUIREMENTS, WRITE OUR SUBSIDIARY, CHICAGO THRIFT-ETCHING CORPORATION, 1555 SHEFFIELD AVENUE, CHICAGO 22, ILLINOIS

## Here's the New, Compact Delanium Graphite Heat Exchanger



HIGH CORROSION RESISTANCE. The Delanium cube is a dense, impervious graphite suitable for handling highly corrosive materials.

WITHSTANDS HIGHER PRESSURES. Working range of up to 100 psi permitted by this sturdy, cubic design and dense Delanium graphite.

REDUCES MAINTENANCE. The compact, rugged cube eliminates breakage hazard usually encountered in cleaning long tubes and handling fragile tube bundles. All graphite parts are metal enclosed.

INCREASES VERSATILITY. With all heads and blocks interchangeable, flow may be varied by changing heads. Units serve as liquid to liquid exchanger, evaporator, or condenser. Operate horizontally or vertically. Manifolded in series, basic units provide increased surface; in parallel, they eliminate shutdown during routine maintenance.

DESIGNED FOR ADAPTABILITY. Also available with a slotted unit to perform as gas cooler or partial condenser.

SAVES SPACE. 50 sq. ft. of surface are compacted into the 15-inch cube.

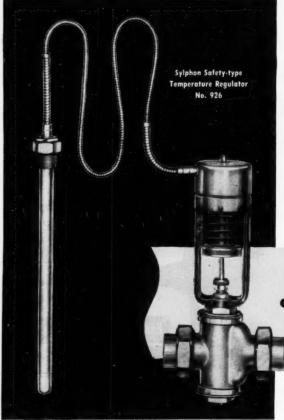
Delanium's engineers will be glad to work with you on your problems.



Delanium Carbon Corporation 18 East 48th St., New York 17, N. Y. In England: Powell Duffryn Carbon Products Ltd. Nayes, Middlesex, England

Some of the leading companies that have installed "Delanium" Exchangers

Stauffer Chemical Company • Heyden Chemical Corporation • American Cyanamid Company
Hoffman-LaRoche, Inc. • General Aniline & Film Corporation



# REEP YOUR PROCESSING PROFITS FROM BURNING UP!

Sylphon Regulator automatically prevents accidental over-heating

I F YOUR PROCESSING OPERATIONS require positive temperature control—and insurance against accidental over-heating—this Sylphon Safety-type Regulator can handle the job perfectly.

If its connecting tubing or bulb should be accidentally injured, causing loss of the thermostatic charge, the control valve closes automatically. Result—over-heating and consequent damage to products in process is prevented.

What's more, this dependable regulator assures

uniform processing conditions. Spoilage is reduced. Manpower, man hours and fuel are saved.

Sylphon Regulator No. 926 can be supplied with fin type bulb for controlling temperature of air or gases. Or, it can be furnished with a reverse-acting valve for cooling control—and the control valve will *open* if the thermostatic charge should be accidentally lost.

Sturdy, neat and compact, No. 926 will serve faithfully—trouble-free—for years. Used for control of: chemical heating tanks, cooling of mixing tank reactions, engine and compression cooling, heating of water for showers, etc. Ideal as standard equipment. For complete details about No. 926, write for Catalog RC-A.





Temperature Controls . Bellows Devices . Bellows Assemblies

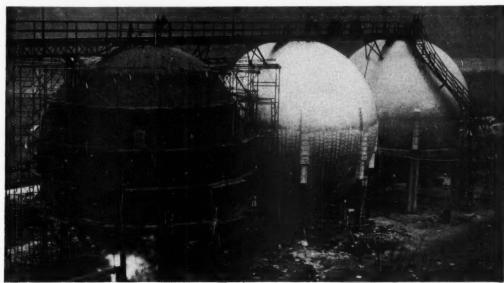
FULTON SYLPHON

ROBERTSHAW-FULTON CONTROLS CO. KNOXVILLE 4. TENN.

Canadian Representative: Darling Brothers. Montreal

# he old insulation rotted and fell off—

### NOW THEY PLAY SAFE WITH FOAMGLAS



● You should have seen these ammonia storage tanks—the old insulation was soaked with water and so rotten that it fell off in big chunks.

The owner decided that now was the time to do a real insulation job to hold these tanks at the required 15°F. FOAMGLAS was chosen because it is an excellent insulation and will not absorb water. And, since it is a true, inorganic glass, Foamglas is impervious to all common corrosive chemicals -an important feature in a chemical plant like this.

FOAMGLAS is so easy to cut and fit that it was no trick at all to install it on these spherical tanks. You can cut FOAMGLAS with a saw, or simply score it and break it. Being a friable material, it can be pressed down over rivet heads or other objects and it will stay in place.

Let us send you a free sample of FOAMGLAS along with our latest booklet. Just mail the coupon.

PITTSBURGH CORNING CORPORATION . PITTSBURGH 22, PA.



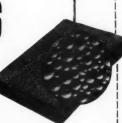
Insulation Contractor: Industrial Furnace Supplies, Inc., Pittsburgh, Pa.



FOAMGLAS

the cellular glass insulation

The best glass insulation is cellular glass. The only cellular glass insulation is FOAMGLAS. This unique material is composed of still air, sealed in minute glass cells. It is light weight, incombustible, verminproof. It has unusually high resistance to moisture, chemicals and many other elements that cause insulation to deteriorate.



**Pittsburgh Corning Corporation** Dept. CC-92, 307 Fourth Avenue sburgh 22, Pa.

FOAMGLAS and your FREE booklet on the use of FOAMGLAS for Piping and Process Equipment.

## How would <u>YOU</u> solve these 2 problems?



MAKING TYPE READABLE is important to newspapers. Faulty temperature control in the lead alloy melting pots of linotype machines can cause fuzzy or broken type. But not with the control manufactured by Linotype Parts Company, Inc. They use accurate, long-lasting Fenwal THERMOSWITCH® thermostats.



CORROSION RESISTANCE is vital to Armed Forces equipment. To meet industry's needs in determining corrosion-humidity resistance, the Industrial Filter & Pump Mfg. Co. developed a salt-fog and humidity testing cabinet. Tests involve close control of temperature. So, each cabinet relies on a Fenwal Junction-Box THERMOSWITCH thermostat.



A FENWAL THERMOSWITCH CONTROL® may solve your problem, too. Its external single-metal shell expands or contracts instantly with temperature changes, making or breaking enclosed electrical contacts. Compact, highly resistant to shock and vibration, Fenwal THERMOSWITCH units have solved hundreds of problems.

\*Junction Box Type illustrated.



SIND FOR THIS NEW CATALOG for complete explanation of the unique THERMOSWITCH unit. Also ask for more detailed, illustrated discussions of the problems above. Fenwal engineers will be glad to help you solve your temperature control problems involving heat, humidity, radiant heat, pressure and other variables. Write Fenwal, Incorporated, 169 Pleasant Street, Ashland, Mass.



#### THERMOSWITCH\*

Electric Temperature Control and Detection Devices
SENSITIVE...but only to heat

## This man has information on over 1000



#### The Combined Experience of all Swenson Engineers Assures Better Processing at LOWER COST For You!

Chemical processing firms throughout the world have been helped by Swenson engineers in the development of over one thousand evaporator installations! The problems encountered and the solutions effected are known by every one of our engineers—and you can have this combined experience-just for the asking.

Swenson engineers saved these firms large sums of money and helped greatly to speed the production of uniform, quality products. Previous experience and its

application to each particular problem was an important reason for such accomplishments. Outstanding results have also been attained in many hundreds of filtration, crystallization and drying installations.

So use Swenson experience! Talk to a Swenson Engineer now... before you plan so that he can help you plan. Let him do much of the "tough" work . . . analysis, layout and design, and recommendation of equipment. You will be assured of an installation that meets every specific requirement!

#### SWENSON EVAPORATOR COMPANY

15670 Lathrop Avenue Harvey, Illinois











EVAPORATORS

CRYSTALLIZERS



Which items of existing facilities can be retained?
Which can be economically rebuilt? Which
must be replaced? When you consider converting your
plant from one type of operation to another,
let trained Wigton-Abbott engineers answer these questions
expertly. They will study your problem from every
angle and come up with a complete plan. This is one
phase of the 5-point service to the chemical industry
offered by the Wigton-Abbott Corporation—a service
available separately or as part of
an overall plant construction project.

Yours for the asking

"Packaged Plant Construction". Reading time, only 10 minutes but it will save you many hours by answering basic questions.



WIGTON-ABBOTT
SERVICES TO THE
CHEMICAL INDUSTRY

DESIGN AND CONSTRUCTION FROM PILOT PLANT DATA

PROCESS DESIGN FROM CLIENT'S FLOW SHEET

ECONOMIC SURVEYS
AND ANALYSES

THE DEVELOPMENT

CONVERSION OF EXISTING FACILITIES

## Wigton-Abbott Corporation

DESIGNERS...ENGINEERS...CONTRACTORS...PLAINFIELD, NEW JERSEY

# Hooker Chemical Guide

USE this handy reference to save time in selecting high quality chemicals.

# HOOKER CAUSTIC SODA

## Used in these products and processes:

wood pulp soap glass chemical intermediates phenol resorcinol naphthol oxalic acid indigo sodium salts pigments aniline dyes ceramics pharmaceuticals cosmetics viscose rayon cleaning compounds reclaiming rubber mercerizing cotton reclaiming tin food processing reclaiming paper metal ore refining bleaching textiles petroleum refining dyeing textiles engraving printing textiles lithography water softening

and many, many others

50% LIQUID	FLAKE		
73% LIQUID	SOLID		

#### DEPENDABLE DELIVERIES

When you order chemicals from Hooker, you know that you are dealing with a reputable, dependable supplier. You can count on prompt deliveries, timed to fit your production schedule.

#### GROWING...TO SERVE YOU BETTER

New Chicago Office—To better serve Midwestern chemical users, Hooker has recently opened an office at 1 North LaSalle Street in the heart of Chicago's Loop. Midwestern users need only call Chicago, CEntral 6-1311, to receive fast shipment from the main plant at Niagara Falls. Hooker technical personnel will also be stationed at the Chicago office to assist you with your chemical requirements.

**New plant at Montague, Michigan**—In addition to the existing plants at Niagara Falls and Tacoma, Hooker is building a plant at Montague, Michigan which will increase chlorine and caustic soda production by 100,000 tons per year. Construction will be completed in 1953. This plant will further speed deliveries to Midwestern users.

**Research and development**—Over 100 regular products, and many more research products, have been made available through Hooker's specialized experience in chlorination, hydrogenation, esterification, sulfhydration, hydrochlorination, and fluorination. Complete laboratory and pilot plant facilities are ready to serve you.

**Products available now**—Chlorine, muriatic acid, sodium sulfide, chlorobenzenes, and many other products are available for immediate shipment. For full information, write on your letterhead to *Hooker Electrochemical Company*, 15 Forty-Seventh Street, Niagara Falls, N. Y.

#### HOOKER ELECTROCHEMICAL COMPANY

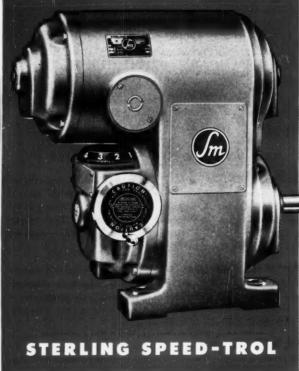
NIAGARA FALLS, N. Y. • NEW YORK, N. Y.
TACOMA, WASH. • CHICAGO, ILL. • WILMINGTON, CALIF.

From the Sall of the Earth



2-1242

# WATER CONDITIONING & TREATMENT AIDED BY



#### STERLING SPEED-TROL!

Accelators are engineered to permit precise adjustment for the many variations in water characteristics encountered in water conditioning and waste treatment... Speed-Trols play an important part in achieving this versatility... as impurities, temperature, etc., change recirculation of slurry is varied accordingly by accurate speed adjustment of the rotor-impeller. This operation requires the infinite speed adjustment and positive speed regulation of Speed-Trols, reports Lawrence K. Cecil, Vice President of INFILCO Inc.

STERLING SPEED-TROL GIVES YOU VARIABLE SPEED CONTROL NECESSARY FOR:

**EQUIPMENT ADAPTATION TO:** Sequence synchronization—operators' abilities—load variations due to differences in quantity, quality, weight, size, tension, hardness or shape of material to be processed, machined, conveyed, blended, mixed, etc.

**PROCESS CONTROL OF:** Temperature—viscosity—level—pressure—flow—etc.

TIME CONTROL OF: Baking-drying-heating-cooking-pasteurizing-soaking-chemical action-etc.

With Speed-Trol you get the maximum in production, plant efficiency, quality and profit.

#### OTHER STERLING ELECTRIC POWER DRIVES:

. STERLING SLO-SPEED (GEARED) MOTORS

. STERLING KLOSD AND KLOSD-TITE (NORMAL SPEED) MOTORS

DRIP-PROOF . SPLASH-PROOF . TOTALLY ENCLOSED



#### 70 ILLUSTRATIONS

showing how Sterling Electric Power Drives reduce production costs. Write for Bulletin No. 3-119



MOTORS

Plants: New York City 51; Van Wert, Ohio; Los Angeles 22; Hamilton, Canada; Santiago, Chile.

Offices and distributors in all principal cities.



CHEMICAL ENGINEERING—September 1952

# If Corrosion is a Problem, "Fastenings by HARPER" is the Answer



431

## Where industry has the "need" Oronite Chemicals supply the way



Most **ORONITE PRODUCTS** 

are available now-

A partial list of

Polybutenes makes them useful in ORONITE PRODUCTS electrical insulation. Their tackiness is Detergent Alkane important in adhesives. Their non-drying Detergent Slurry characteristic makes possible superior Detergent D-40 caulking, sealing and insulating compounds. Detergent D-60 They are extensively used as extenders Wetting Agents and modifiers in making molded rubber Lubricating Oil Additives Cresylic Acids Gas Odorants Sodium Sulfonates

Oronite's specialty is finding ways to mass-produce needed chemicals. We may already

ORONITE was the pioneer in the development of a chemical called "Polybutenes." Today, industry looks to Oronite as a major

source of this very versatile chemical. The high dielectric strength of Oronite

have in mass production a chemical you need, or perhaps we could place one in production for you. A letter or telephone call will place our experience and facilities at your disposal.

# some are in short supply Please inquire! products. Possibly Oronite's versatile Polybutenes will solve a problem for you.

#### ORONITE CHEMICAL COMPANY

38 SANSOME ST., SAN FRANCISCO 4, CALIF. 30 ROCKEFELLER PLAZA, NEW YORK 20, N.Y.

STANDARD OIL BLDG., LOS ANGELES 15, CALIF. 600 S. MICHIGAN AVENUE, CHICAGO 5, ILL. MERCANTILE SECURITIES BLDG., DALLAS 1, TEXAS

**Purified Sulfonate** 

Naphthenic Acids

Phthalic Anhydride

Ortho-Xylene

Para-Xylene

**Xylol** Aliphatic Acid Hydroformer Catalyst

### For Practical, Helpful Information On

- Mixing and agitating equipment
  - 2. Vessels, tanks, reactors and process units
    - 3. Heat exchangers
      - 4. Process plant engineering and design

. be sure <u>you</u> receive these monthly bulletins



problems, and how they were solved. Curiosity? Maybe. But more likely there's the hope of getting an idea that will help you with one of your own problems.

It's something new for the chemical and process industries.

Since you're not always free to have an Industrial Process Engineer sit down with you to discuss how I \* P \* E's equipment is designed and built to solve particular processing problems, these bulletins present the kind of case-history information you want.

> Just send the attached coupon for your copies. And when it comes to DESIGN and/or FABRICATION of process equipment, check  $I \star P \star E$  for . . . engineering design . . . workmanship . . . cost . . . delivery . . . service.

NDUSTRIAL PROCESS FINGINEERS	1		9-
ENGINEERS			

2 Lister Avenue, Newark 5, New Jersey

Engineers, Designers and Manufacturers of Process Plants and Equipment

INDUSTRIAL PROCESS ENGINEERS 2 Lister Ave., Newark 5, N. J.

Please send me your engineering bulletins.

NAME: \_\_

POSITION: COMPANY: \_\_

# five reasons why chemical men specify **INLAND** steel containers



hot liquids

corrosives

Buy WILFLEY for cost saving performance

Companion to the famous WILFLEY Sand Pump

acids

- · For more efficient performance...greater economy of operation...specify WILFLEY "AF Acid Pumps. Dependable, trouble-free operation, on a round-the-clock schedule, with consequent stepped-up production and worthwhile power savings, are big reasons why modern chemical and processing plants all over the world now rely on WILFLEY Acid Pumps for handling acids, corrosives, hot liquids and mild abrasives.
- · Available in 10- to 2,000-G.P.M. capacities, 15- to 150-ft. heads and higher. Wetted parts of practically all machineable alloys. Plastic lined models available. Every application individually engineered. Write or wire for details.



A. R. WILFLEY & SONS, Inc., Denver, Colorado, U.S.A. New York Office: 1775 Broadway . New York City

PUMPS

### **How Would You**

# 'COOL OFF"

# **Boiling Hydrochloric Acid?**

# THIS CONDENSER...STILL GOOD AFTER 2½ YEARS SERVICE ...PROVIDES AN ANSWER

Where processing equipment is exposed to strong corrosives, trouble and expense may often be eliminated by use of a high nickel alloy.

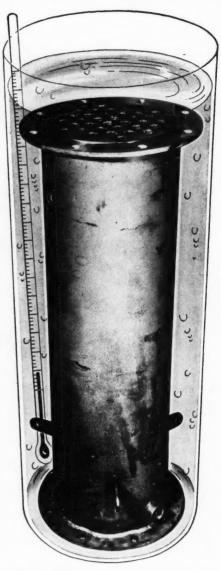
For instance, a series of nickel-base alloys trade-named "Hastelloy," produced by the Haynes Stellite Company, Kokomo, Indiana, a Division of Union Carbide and Carbon Corporation, are widely used for components exposed to corrosion from sulfuric and hydrochloric acids.

Hastelloy alloy B... selected for tubes and end plates of the condenser shown above... has given more than  $2\frac{1}{2}$  years of service in hydrochloric acid distillation, 2 to 3 days per week, 8 hours per day, yet shows no visible deterioration.

The fabricator, Kay Industries of Detroit, chose this high nickel alloy because it is one of the very few commercially available materials adequate to handle acid in concentrations that vary from 1 to 10%, with temperatures up to the boiling point ... making it one of the most corrosive agents known to the chemical industry.

Hastelloy alloy or some other high nickel alloy may be the complete answer to your particular equipment or production problems. Write us, today, for counsel and data.

At present, most of the nickel produced is being diverted to defense. Through application to the appropriate authorities, nickel is obtainable for the production of engineering alloys for many end uses in defense and defense supporting industries.

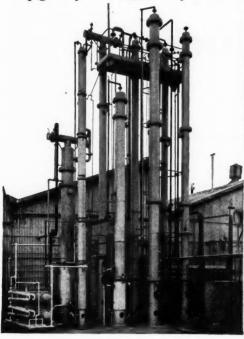


COMPONENTS OF HIGH NICKEL ALLOY WITHSTAND BOILING ACIDS. Condenser tubes 1/2" in diameter, welded from 16-gauge Hastelloy alloy B, and end disks of the same material, 3/8" thick by 7" diameter, are still good after 2 1/2 years exposure to one of the chemical industry's most corrosive agents . . . boiling hydrochloric acid.

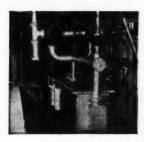


THE INTERNATIONAL NICKEL COMPANY, INC. 67 WALL STREET NEW YORK 5, N. Y.

## Oxygen plant not required!



Wulff Process Recovery and Purification section. In operation over 19 months, the plant has sold acetylene commercially for the past 10 months.



This fully automatic cracking furnace is the heart of the Wulff Process. In the past 10 months of commercial operation, this unit has required no maintenance—capacities and yields have remained the same.

#### **Available from Fluor**

The Wulff Process for the production of acetylene from hydrocarbons is available through The Fluor Corporation. With over 30 years' experience in the design, engineering, and construction of plants and facilities for the petroleum and chemical industries, Fluor possesses the background, the skilled personnel, and the know-how essential for the practical application of the Wulff Process into your particular program.

## THE WULFF PROCESS

Acetylene from natural gas, ethane, propane, butane, or any LPG mixture

## available through Fluor!

The manufacture of acetylene from hydrocarbons by thermal pyrolysis is now commercially feasible and economically attractive! This has been proved. In January, 1951, the Wulff Process Company placed in experimental operation a commercial-sized acetylene plant. The plant has been operating continuously for the last 19 months. During the last 10 months of this period, acetylene has been sold commercially. This same process may be applied to plants making as little as one ton per day of acetylene to as much as one hundred tons or more per day.

The Wulff Process Company plant has experienced continuous operation on a wide variety of hydrocarbon feed stocks. Methane and propane have been used commercially. Test operations with ethane, butane and various hydrocarbon mixtures have demonstrated that a single plant with modification only in operating conditions can be used for a number of feed stocks. The process can be operated to produce substantial yields of commercial grade ethylene simultaneously.

Regardless of whether your activities lie in the production of petrochemical feed stocks, the manufacture of end petrochemical products, or both, it will pay you to investigate this commercially proven process for the recovery of low-cost acetylene from hydrocarbons. Your nearest Fluor representative will be pleased to provide detailed information on specific requirements. Contact him today!

## FLUOR

Engineers - Constructors - Manufacturers

THE FLUOR CORPORATION, LTD. - LOS ANGELES - HOUSTON New York, Chicago, Pittsburgh, Boston, Tuisa, San Francisco, Birmingham and Calgary

Represented in the Starling areas by Wead Wrightson Processes Ltd., Teesdale House, Battic Street, London, E.C.I., England



# all one piece .. finned tube

The fins are extruded from the tube itself

These two views show the construction of Wolverine Trufin\* - the integral finned tube. The large drawing illustrates how the fins are formed from the wall of the tube and remain a part of it. Thus, Trufin's efficiency is unaffected by vibration or sudden temperature changes. This finned tube can be fabricated as easily as plain tube. Trufin has an outside surface area many times that of plain tube and points the way to greatly increased efficiency. In addition Trufin can often help you reduce unit size, installation and maintenance time, thus lowering your costs. Find out about Trufin, the integral finned tube, and its relation to your own heat transfer application. Available in a variety of sizes, fin spacings and alloys. Send for your copy of the new brochure, Wolverine Fabricated Parts.

\*Reg. U.S. Pat. Off.



#### WOLVERINE TUBE DIVISION



Calumet and Hecla Consolidated Copper Company Incorporated

Manufacturers of tubing exclusively 1427 CENTRAL AVENUE . DETROIT 9, MICHIGAN

Plants in Detroit, Michigan and Decatur, Alabama; Sales Offices in Principal Cities

Wolverine Trufin and the Wolverine Spun End Process available in Canada through the Unifin Tube Co., London, Ontario

Export Department, 13 E. 40th St., New York City 16, N. Y.

# a pressure controller

that's tough...
versatile...
dependable

### Complete with every feature you need

#### SET POINT

Differential screw permits accurate adjustment of set point; no gears or other cumbersome devices.

#### OVERLOAD PROTECTION

Unique over-pressure safeguard prevents damage to control mechanism.

#### REVERSAL OF ACTION

Control can be changed from direct acting to reverse in just 30 seconds, by a single adjustment. No pressure connections need be broken.

#### UNIVERSAL MOUNTING

Light, compact case can be mounted wherever convenient: on valve yoke, wall, panel front, or flush in panel.

#### PROPORTIONAL BAND

Readily adjustable from 1 to 100%, on a clearly graduated scale.

#### **UNIT CONSTRUCTION**

Simplified design speeds cleaning, repair or replacement of sub-assemblies.



### the new

#### HONEYWELL PRESSURE PILOT

A pressure controller of unusual ruggedness and versatility, the Honeywell Pressure Pilot is an ideal means of regulating hydraulic systems, pipe lines, pump outlets and other applications where more expensive indicating and recording instruments are not warranted.

It utilizes a Bourdon tube sensing element, flapper-and-nozzle control assembly, and a pneumatic booster relay . . . all combined in a sturdy, low-cost unit capable of remarkably accurate control

See the Pressure Pilot at first hand, right in your own plant. Our local engineering representative will be glad to demonstrate it; just call him today . . . he is as near as your phone.

MINNEAPOLIS-HONEYWELL REGULATOR Co., Industrial Division, 1904 Windrim Ave., Philadelphia 44, Pa.



Honeywell

First in Controls

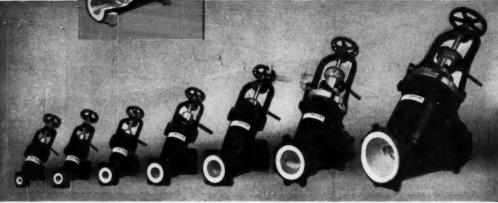
• Important Reference Data

Write for New Bulletin 16-1, "Honeywell Pressure Pilot."



PRIMARY PROTECTION FOR PERSONNEL . . . EQUIPMENT . . .

PRODUCT . . .



# Lapp TUFCLAD

SOLID Chemical Porcelain

ARMORED with FiberglassReinforced Plastic



Y-Valves, as shown, and Angle Valves are available in Lapp TUFCLAD Chemical Parcelain in ½,", 1", 1½", 2", 3", 4" and 6" sizes. Also safety valves, flush valves, plug cocks, pipe and fittings (to 8" dia.) and special shapes.

When?'s your first worry in case of minor fire or explosion or accident? You can get a big one off your mind with installation of Lapp Chemical Porcelain with TUFCLAD Fiberglass-reinforced plastic. Without special construction for protection, you have all the advantages of a solid porcelain system with extra security for personnel, equipment and product.

TUFCLAD provides a cushion to protect porcelain against accidental damage in handling or operation—and as insulator against thermal shock. And the TUFCLAD shell is of itself tough—fully able to hold operating pressures against gross leakage even though porcelain is damaged by accident, explosion or fire.

WRITE for description and specifications. Lapp Insulator Co., Inc., Process Equipment Division, 510 Maple St., Le Roy, N. Y.



When you need gaskets such as those above, which were made for pressure vessel service over 5000 psi, consider this. It takes less time and trouble to turn the job over to J-M Goetze—an organization that has specialized in gasket design and manufacture for 67 years. And it usually costs less in the long run.

Goetze engineers can select the right style for maximum sealing efficiency. They know the correct metals and other factors required for efficient, long-lasting gaskets. Goetze Gaskets are made exactly to the last detail of your specifications and conditions. They are made to craftsmen's perfection . . . with modern machine tools, some of which were specially designed by Goetze for gasket manufacture.

If you need gaskets for high pressure vessels or similar applications, send us a drawing or template for quotation. Or write for further information to Johns-Manville, Box 60, New York 16, New York.



Johns-Manville *Goetze* GASKETS

THERE'S A JOHNS-MANVILLE PACKING AND GASKET FOR EVERY SERVICE

Semi-Steel or Cast Steel Threaded or Flanged Ends

#### THESE VALVES.

HAVE CURED

A LOT OF MAINTENANCE

**HEADACHES**, because they...

### **AUTOMATICALLY ADJUST FOR WEAR**

Wear, that in most valves would cause leakage and necessitate complete valve renewals, simply doesn't faze a HOMESTEAD-REISER.

Its two-piece, wedge-acting plug constantly and automatically adjusts itself to make up for wear as wear occurs. The valve acts on its own. It is SELF-SEALD!

Result: Extra long, leakless service life . . . more operations between lubrications . . . less maintenance ... lower plant operating costs.

Available in semi-steel or cast steel; 100% port area or Venturi type; sizes 15" to 14" for steam working pressures to 150 lbs.; or oil . . . water . . . gas to 200 lbs.

Complete data and prices will be sent on request. Write today for VALVE REF-ERENCE BOOK No. 39. No obligation.



Worm and Gear Operated

### HOMESTEAD

VALVE MANUFACTURING CO.

P. O. BOX 13

"Serving Since 1892"

CORAOPOLIS, PA.



Homestead Reiser's self-sealing action is based on what we believe is the most effective sealing principle ever developed for lubricated plug valves.

Its secret is the wedge-action of the two-piece plug

which, under line pressure, causes the finely finished surfaces of the plug to press outward against the body.

A full lubricant seal surrounds the ports, and the top and bottom of

The self-sealing, wedge action keeps

the plug surfaces in constant contact with the mirror-like bore of the body. It provides automatic adjustment for ar and assures extra long valve life







They can help you save 5 to 20% over the cost of mechanical refrigeration, if you have live or exhaust steam available, and require moderate chilled water temperatures from 35° to 65°F. Purchase price is lower, because units are standardized in a wide range of sizes. Installation costs less. And — most important of all — long range maintenance cost is lower. There are no moving parts in the system except the chilled water pump.

Employing only water, cooled by flash evaporation, you eliminate hazards of noxious and poisonous refrigerants.

Most C. H. Wheeler installations are of a confidential nature. Our engineers will be glad to work with you in applying the correct vacuum equipment for your process.

Catalog 1462, yours for the asking, has many suggestions and charts of value to you who have a vacuum or refrigeration problem.

C.H. Wheeler CRO-PARTICLE

VACUUM REFRIGERATION—COOLING TOWERS—HIGH VACUUM PROCESS EQUIPMENT—MICRO-PARTICLE
REDUCTION MILLS—STEAM CONDENSERS—STEAM JET EJECTORS—MARINE CONDENSERS & EJECTORS—DECK MACHINER

C. H. WHEELER MANUFACTURING CO., 1832 SEDGLEY AVE., PHILADELPHIA 32, PA.



For any reasonably free-flowing material the advantages of a vertical type mixer can be overwhelming!

In space and power savings, they are unique. Imagine a 1,200 cu. ft. mixer requiring a space only 10 ft. square, and using only 30 horsepower to mix 32 tons of material!!

As the world's most experienced designers and fabricators of this type mixer we've built them in sizes ranging from 10 to 1,200 cu. ft., of carbon steel, of stainless steel, of plexiglas—with self-loading and self-unloading features—with provisions for cooling and drying while mixing! They're self cleaning—they require the minimum of labor.

Ask a Sprout-Waldron representative to study your mixing problem, or write for full details to Sprout, Waldron & Company, Inc., 15 Logan Street, Muncy, Pennsylvania.



SPROUT-WALDRON

The Bost in PROCESSING EQUIPMENT Since 1866

240

# Castings in Stainless

in Stainless and Special Alloys...

# require <u>Control</u> in Core-setting



There is just no "good enough" way to set cores, for close tolerances must be held if costly, time-consuming, corrective work is to be eliminated—and time is vital today. Core-setting and its companion step, core-making, call for precise skill and infinite care, yet these are but two of many production procedures followed with such care by all Lebanon craftsmen to produce CIRCLE © castings of controlled high quality.

#### LEBANON STEEL FOUNDRY

Lebanon, Pennsylvania
"In the Lebanon Valley"



LEBANON

Steel and Alloy Steel

Castings

# Make These 4-WAY SALT SAVINGS

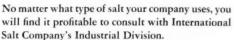
yours with the help of International Salt Company's Industrial Engineers

1. SAVINGS ON STORAGE by engineering the most efficient and compact salt storage system to fit your situation.

2. SAVINGS IN LABOR by reducing effort and supervision involved in salt or brine handling.

3. SAVINGS ON WASTE through accurate salt measurement and ending of spillage and spoilage.

**4.** SAVINGS IN USE. Research and field work with hundreds of industries in many fields equip International to show you how best to use salt in product processing—and for product improvement, too.



As part of International's service to industry, this experienced organization will acquaint you with latest advances in salt use in your field. And can advise you on all aspects of salt storage and handling, brine making, and salt and brine uses.

Here you'll find four ways to save money—and very probably, *important* money.

#### Qualified on all Counts

International Salt Company's Industrial Division is endowed with the experience of one of America's largest salt producers. This company produces all types of salt and operates from strategically located mines and refineries.

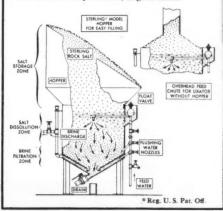
As supplier to all industry, it is constantly in touch with salt developments in all fields. Many such developments, in fact, have been pioneered by International Salt Company.



#### LIXATOR\*-A NOTABLE EXAMPLE

The Lixator is one of International's outstanding advances in salt technology. Utilizing Sterling Rock Salt, the Lixate principle of self-filtration, invented and developed exclusively by the International Salt Company, provides a steady flow of pure, clean, fully saturated brine.

No handling or attention is required beyond the hopper-loading stage—gravity does all the work. The Lixate Process is adaptable to almost numberless industrial requirements, large or small.



#### INTERNATIONAL SALT COMPANY, INC., Scranton, Pa.

SALES OFFICES: Atlanta, Ga. • New Orleans, La. • Boston, Mass. • St. Louis, Mo. • Newark, N. J. Buffalo, N. Y. • New York, N. Y. • Cincinnati, O. • Philadelphia, Pa. • Pittsburgh, Pa. • Richmond, Va. ENGINEERING OFFICES: Atlanta, Ga. • Chicago, Ill. • Buffalo, N. Y.

### You can't stop a gusher with a bottle cap



You can't stop corrosion with ordinary paints . . .

# it takes BITUMASTIC COATINGS!

**CORROSION** can't be stopped by ordinary paints or conventional protective coatings. They can't protect surfaces against the ravages of rust for any appreciable length of time.

But Bitumastic Coatings can!

Unlike maintenance paints, Bitumastic® Protective Coatings are specially formulated from a base\* of coal-tar pitch that is, for all practical purposes, impervious to water. When you keep moisture away from an exposed surface, you stop corrosion.

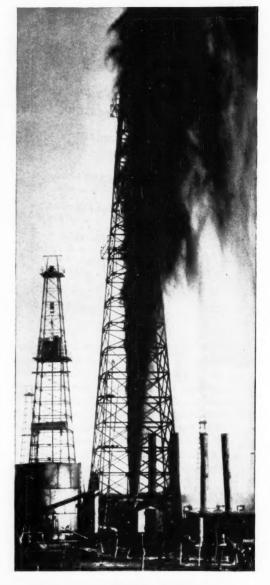
Bitumastic Coatings provide an extra-tough, extra-thick barrier against corrosive elements—a barrier that is impenetrable. And these coatings provide up to 8 times the film thickness of conventional paint coatings.

Bitumastic Coatings stop corrosion caused by moisture—acid fumes—alkaline fumes—corrosive soil—salt air—heat.

\*Hi-Heat Gray contains a metallic base.

There are 6 Koppers Coatings—formulated to control corrosion of metal and deterioration of concrete. Use the coupon for full information.

Koppers Dept. 95				duc	ts E	livis	ion		
Please booklets					or	ob	liga	ition,	you
Name	 	***	 	 					
Address	 		 	 					





BITUMASTIC PROTECTIVE COATINGS

SOLD THROUGH INDUSTRIAL DISTRIBUTORS

KOPPERS COMPANY, INC., Tar Products Division, Dept. 952T, Pittsburgh 19, Pa.

DISTRICT OFFICES: BOSTON, CHICAGO, LOS ANGELES, NEW YORK, PITTSBURGH, AND WOODWARD, ALA.

# Your Guide to PROFITABLE DRYING



#### Send FOR YOUR COPY TODAY!

Examples of how Standard-Hersey Dryers make money for their operators. Special features and advantages of Staudard-Hersey Dryers (Siling, Coolers and Calciners How our "pilot" dryer takes guesswork out of dehydrating problems. Write for Dryer Bulletin 308.



STANDARD STEEL CORPORATION 5005 Boyle Ave., Los Angeles 58, Calif. 419-5 Commonwealth Ave., Boston 15, Mass.

# FILTER

FOR ALL PURPOSES

ALKALI RESISTANT • ACIDPROOF • HEAT RESISTANT

Press sacks, tubes, discs, rotary covers,

Centrifugal Liners, and Dust Arresting Bags, Etc.

WOVEN GLASS & "DURAKLAD"
PLASTIC CLOTHS

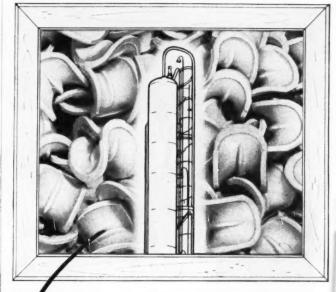
VINYON - NYLON - SARAN - STANTE

Filter Paper for Plate and Frame Presses

Write for Samples.
State Width, Style of Press.

Wm. W. STANLEY CO., Inc.

401 BROADWAY
NEW YORK CITY
Factories: NEW YORK & VICTOR, N. Y.





# When tower efficiency must be increased, Berl Saddles belong in the picture!

When the problem is how to increase tower efficiency in present or new equipment, that's when Berl Saddles enter the picture.

#### REASON:

Berl Saddles are a more efficient tower packing than raschig rings, spiral rings or partition rings. They offer greater surface area, lower resistance to gas flow, lower pressure drop, higher flow capacities, greater free space and better internal distribution. They are entirely acid proof, have a high crushing strength and will not spall.

Berl Saddles are available in both Knight-Ware Chemical Stoneware and porcelain. Both are dense but unglazed to provide better wetting. When desired porous packing can be made of either material.

Berl Saddles are available in sizes: 1/4", 1/2", 3/4", 1", 11/2", 2".

Write for data sheet No. 13B, Knight-Ware Tower Packings.

Maurice A. Knight 109 Kelly Ave., Akron 6, Ohio
Acid and Alkali-proof Chemical Equipment

# What do you do when your v-belts get loose or break? Leave the drive alone

Slide the motor back

Tight belts get too tight

Life of belts and bearings is reduced



Install a new set of belts Discarded belts mean wasted

You get more

wasted po excessive belt

slippage

Only with VEELOS ...

the adjustable v-belt-can you get all these operating advantages. And only with Veelos can you eliminate costly v-belt inventory because just four reels of Veelos in the O, A, B and C widths can replace up to 316 different sizes of endless v-belts.

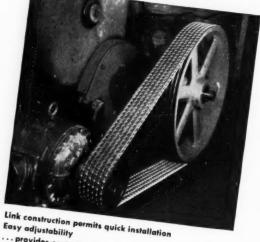
VEELOS DATA BOOK ...



The plain facts on construction, installation and use of Veelos are included in this illustrated Data Book write for your copy.

MANHEIM MANUFACTURING & BELTING COMPANY 602 Manbel St., Manhelm, Pa.

Use VEELOS ...



... provides controlled tension on each belt · · · eliminates loafers

Keeps your machines running for profitable production

V-BELT

ADJUSTABLE TO ANY LENGTH . ADAPTABLE TO ANY DRIVE

Made in all widths in three types: regular, oil-proof, static conducting. Also double V in O, A and B. Packaged on reels in 100-foot lengths. Sales engineers in principal cities; over 350 distributors throughout the country. VEELOS is known as VEELINK outside the United States.

#### DIFFERENTIAL PRESSURE CONTROL

FOR HIGH PRESSURES



Mercoid Type BB Differential Pressure Controls open or close a switch contact according to a change in the difference between two pressures.

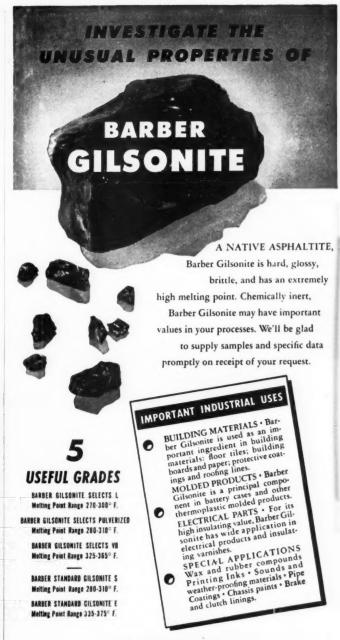
Type BB employs two Bourdon tubes, each responsive to a pressure condition to operate a Mercoid Magnet operated mercury switch as the difference in pressure between them increases or decreases. Available in ranges 60 p.s.i. to 2,500 p.s.i.

Electrical Capacity—A. C. 115V., 5Amp., 230V., 2Amp., D. C. 115V., 2.5Amp., 230V., 1Amp.

WRITE FOR BULLETIN CA-6DP

THE MERCOID CORPORATION

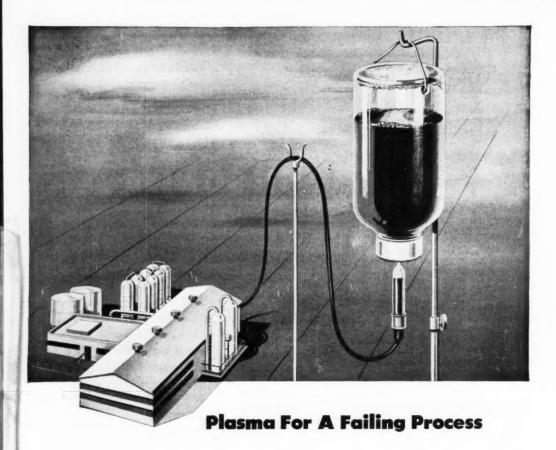




# AMERICAN Bitumuls & Asphalt COMPANY

200 BUSH ST. . SAN FRANCISCO 4, CALIFORNIA

Providence 14, R. I. Perth Amboy, N. J. Baltimore 3, Md. Columbus 15, Ohio St. Louis 17, Mo. Mobile, Ala. Baton Rouge 2, La. Tucson, Ariz. Inglewood, Calif. Oakland 1, Calif. Portland 7, Ore. Seattle, Wash. Washington 6, D. C. San Juan 23, P. R.



Throughput usually suffers when any part of your process gets too weak to keep up with the rest of your system. Here's how one company we know prevented such a problem.

Chlorinated hydrocarbons for use in plastics had to be weighed. Testtube accuracy without metallic pickup, contamination or discoloration was essential. Stability had to be maintained with sub-zero temperatures.

The answer: jacketed weigh tanks on suspended scales. Passage between shells gave ample circulation for coolant, while a nickel-clad steel inner shell assured purity, gave fast, uniform heat transfer. Easy low-cost maintenance and long life also resulted.

Where did this solution come from? It was the result of cooperative development between the engineering staffs of progressive Equipment Builders, process engineers and materials suppliers. In developing such equipment, these better builders regularly turn to Lukens for its knowledge of materials, as well as its wide range of low-cost clad steels.

Even with new equipment hard to get, these builders can often recondition what you have for better, more profitable production. For their names, write us today, explain-

ing your problem. Manager, Marketing Service, 400 Lukens Building, Coatesville, Pennsylvania.





#### LUKENS STEEL COMPANY

WORLD'S LEADING PRODUCER OF SPECIALTY STEEL PLATE . PLATE SHAPES . HEADS . CLAD STEELS



# A lot of engineering for a Component!

and every Speedomax user benefits by it!

Converter's job in Speedomax instruments is to receive the (often very small) direct current signal which is related to the temperature, stress pH or other condition being measured, and produce an alternating voltage. This output is amplified, and then directs the balancing system to measure, record, and if desired control.



Good engineering shows in this Amplifier's thorough filtering, high impedance, and plug-in connection to the rest of the Speedomax.

Good engineering shows in this Slidewire's non-inductive winding and in absence of any flexible leads which might form





Good engineering shows in this balancing motor's small size, and in its torque ample to operate accescontrol and signalling fitments.

• The operating precision of the thousands of Speedomax Recorders and Controllers which serve industry and science begins with the engineering of components like this Converter. Our specifications apply at all stagesall the way back to the plants which make metals, insulation materials, etc., for us. These specs represent also the best thinking of our

The resulting materials are thus qualitysuppliers' engineers. controlled for us-and us alone.

From these materials our engineers tell our factory how to make converter parts to truly tight specifications. Some parts require principally flatness, or elasticity, or dimensional stability. Reeds need correct natural frequency. Many parts of course combine various needs; each gets its requirements.

Life tests show Fidelity and Stamina. Ingenious and often original design creates from these parts a converter with noise level equivalent to only 0.2 microvolt in an emf potentiometer circuit. And this fidelity promotes accurate measurement and control.

Running on life tests since 1948, present-model converters are today still well inside performance tolerances. Such a run equals 21.9 years of 8-hours-a-day, 200-days-a-year-service-or 1.9 years more than the present age of the first Speedomax.

This kind of engineered performance is also built into the amplifier, slidewire, motor and scores of other exclusively Speedomax parts. It's at your service whether you want to control a tower, plot an X-Y function, or record vital facts about atoms or molecules. Call on L&N application engineers in selecting the exact range (from among thousands) and the exact measuring circuit (from among 2300) to meet your needs. Write our nearest office, or 4916 Stenton Avenue, Philadelphia 44, Pa.

CAREER OPPORTUNITIES AT L&N

Expansion program of this long-established firm has many features to attract outstanding recent graduates many features to attract outstanding recent graduates in engineering and science. Opportunities are in sales field engineering, product and application engineering, research, advertising, market development. Widely, respected policies assure recognition of progress and achievement. Address Personnel Manager for preliminary interview at nearest of 17 L&N offices.



instruments · automatic controls · furnaces

Jrl Ad ND46(6b)



When you have an insulated piping problem, remember that only the best will give you ALL the advantages necessary to full-efficiency performance of your system. That means Ric-wil Prefabricated Insulated Piping.

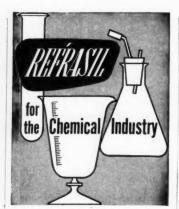
BEST CHOICE

Ric-wiL provides (1) topefficiency system engineering, (2) fast, economical installation, (3) the right protection and insulation for the job.

#### THE RIC-WIL COMPANY CLEVELAND, OHIO



UNDERGROUND OR OVERHEAD



REFRASIL ... widely used today in many industries has rapidly become an important filtration and insulation material for the Chemical Industry.

This outstanding new product is a fibrous, high silica content, all mineral substance which is chemically stable, unaffected by ordinary acids, and is resistant to fire, water and moisture.

REFRASIL, light in weight and versatile in use is available in a variety of physical forms as illustrated below.

#### IMPORTANT FEATURES

- \* Filtration of corrosive or high temperature materials
- \* Chemical resistance of pure silica.
- \* Extreme temperature resistance.
- \* Low thermal conductivity.
- \* Good occustical insulation.
- \* Catalyst or Catalyst support.



Without obligation to you, our engineers are available for consultation regarding your high temperature or fil-tration problems.

tration problems.

REFRASIL is produced in a
wariety of forms for your
needs. Write us today, or
simply attach this ad to your letterhead and mail today for









#### REFRASIL REPRESENTATIVES



Electro-Chemical Manufacturers



These high alumina content porous porcelain products are manufactured under optimum controlled conditions to give maximum efficiency and satisfaction in a wide range of installations. Careful firing to a high temperature, followed by slow cooling, results in micropores of controlled size between chemically bonded particles. Shapes vary from square or rectangular plates to cylindrical open or closed tubes, discs, porous cups, crucibles, and candles.



#### FILTROS "35"

Electrolytic Diaphragms are being used for a wide variety of industrial purposes—here are some typical applications and uses:

- 1. POROUS MEMBRANE in electrolytic cells and batteries.
- 2. POROUS SEPARATOR in dialysis cells. POROUS BARRIER in gaseous diffu-
- 4. In MICROFILTRATION PROCESSES.
- 5. As ADSORBENT or DESICCANT.
- 6. For GAS ABSORPTION.
- 7. CATALYST CARRIER OR SUPPORT 8. For ELECTRICAL INSULATION.

FILTROS "35" Electrolytic Diaphragms are used by such industrial leaders as Buffalo Electro Chemical Co., Penna. Salt Mg. Co., Reilly Tar & Chemical Co., Industria Quimica Mantiqueira, S. A., Electro Quimica Mexicana, S. A.

Leading industries (see above) are using FILTROS "35" Electrolytic Diaphragms—and more uses are being discovered almost daily. It will pay you to investigate.

daily. It will pay you to investigate. FILTROS Engineers are at your service, to help with your specific problems, aided by our research laboratory. Write today for full information.

Others in the complete FILTROS line of porous, acid proof, silica and chemical porcelain products include: Flat and Curved Plates: Cylinders and Rods: Grooved Bottom Plates; Diacs and Tubes.



567 West Commercial St., East Rochester, N. Y.

Pioneer Manufacturers of Porous Ceramics — Since 1913 FROM
THE CASEBOOK
THAT COVERS
THE INDUSTRY



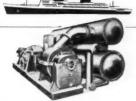
Uses **YORK** Refrigeration
For Uniform Temperature Control

Perhaps uniform refrigeration can help you simplify a process . . . or pare operating costs . . . or step up production within your present space.

At Rayonier . . . world's largest producer of chemical cellulose . . . giant York turbo refrigeration systems keep water at a precise temperature of 50° F. *Precise* temperature is important here, for the manufacture of consistently pure chemical cellulose depends upon it.

Your process may also depend upon uniform temperature control. Or it may demand quick response through a wide variation of precise temperatures. In installing more refrigeration capacity than anyone else, York has dealt successfully with both conditions. York engineers have tailored air conditioning, ice-making and refrigeration equipment to fit the needs of every size of plant and type of industry.

At the other end of your telephone line is your nearest York Branch Office, one of forty which comprise the world's finest refrigeration service facilities. York-trained engineers—their specialized knowledge backed by thousands of successful case histories—are available to discuss, plan and install the equipment you need. Or write directly for information to York Corporation, York, Pennsylvania. The great new superliner, S. S. UnitedStates, has complete York refrigeration for air conditioning and for ships' stores and cargo space! The new queen of the seas is also equipped with large-capacity York-Flak Ice Automatic Ice Makers.



#### YORK TURBO COMPRESSOR

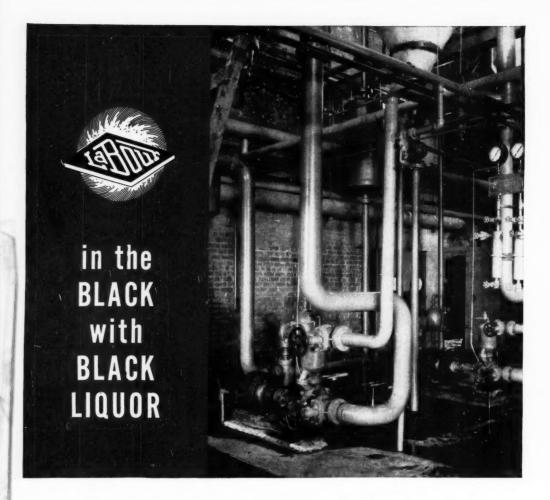
Capacities range from 150 to 2500 tons. Steam turbine or electric motor driven. For air conditioning large buildings . . . for refrigeration in industrial processes.



THE BIG ADVANCES COME FROM

YORK

HEADQUARTERS FOR MECHANICAL COOLING . . . SINCE 1885



It isn't hard to figure what a pump failure would do to operating costs on the five-body, quadruple effect black liquor evaporator served by these pumps. That's why they're LaBours, and *that's* why there's no red ink in the accounting.

This Kraft mill job was built by Swenson Evaporator Company, who specified the LaBour pumps because they've had a lot of experience with them over the years. There isn't any substitute for dependable service, and LaBour's have proved their dependability beyond question.

We'll be glad to show you how LaBour simplicity reduces pump failures and assures uninterrupted service. Just ask us.

ORIGINAL MANUFACTURERS OF THE SELF-PRIMING CENTRIFUGAL PUMP

# LABOUR

tallin.

THE LABOUR COMPANY, INC. \* Elkhart, Indiana, U.S.A.



# he's working for you

THIS FELLOW IS TRAINED IN YOUR BUSINESS. His main duty is to travel the country—and world—penetrating the plants, laboratories and management councils . . . reporting back to you every significant innovation in technology, selling tactics, management strategy. He functions as your all-seeing, all-hearing, all-reporting business communications system.

THE MAN WE MEAN IS A COMPOSITE of the editorial staff of this magazine. For, obviously, no one individual could ever accomplish such a vast business news job. It's the result of many qualified men of diversified and specialized talents.

AND, THERE'S ANOTHER SIDE TO THIS "COMPOSITE MAN," another complete news service which complements the editorial section of this magazine—the advertising pages. It's been said that in a business publication the editorial pages tell "how they do it"—"they" being all the industry's front line of innovators and improvers—and the advertising pages tell "with what." Each issue unfolds an industrial exposition before you—giving a ready panorama of up-to-date tools, materials, equipment.

SUCH A "MAN" IS ON YOUR PAYROLL. Be sure to "listen" regularly and carefully to the practical business information he gathers.



### McGraw-Hill Publications

SERVICE STATIONS...



SWIMMING POOLS



CHECK
CORROSION
FROM
ACIDS AND
ALKALIES
LONGER
WITH

Fast-drying Parlon (Hercules chlorinated rubber) resists acids, alkalies, fumes, and salts three to four times longer than ordinary coatings. Two typical examples of the high protection Parlon gives to surfaces may be found in service stations and swimming pools.

In garages and gas stations, Parlon rubber-base paint on walls and floors resists the deteriorating action of grease, gasoline and other car servicing products. Where car washing is done, Parlon is ideal for protecting concrete, wood, and metal surfaces from alkaline cleaning chemicals and moisture.

Parlon has proved itself a favorite with swimming pool operators for many years because of its long underwater life. It is particularly durable on concrete pools, since it is unaffected by the free alkali in cement. Ask your paint supplier about easy-to-apply and economical-to-use rubber-base paint—or write direct for details.

Cellulose Products Department
HERCULES POWDER COMPANY

952 Market St., Wilmington 99, Del.

RUBBER-BASE (PARLON)® PAINTS

CR52-4

### Here's the

# **ECONOMICAL WAY**

to keep vibration out of rigid piping . . .



CMH corrugated steel and bronze hase is available in standard sizes from  $\frac{\pi}{3}(n^2 + \ln n \log h \, 14^2 + \ln n \log h \, 14^2)$ . The pressures to 12,000 psi, temperatures to 1000° F. Stainless steel types also available.



CMH convoluted hose is available for lower pressure applications in a variety of types including square locked, ball bearing and fully interlocked . . . in steel, bronze and other alloys. Sizes up to 12" 1.D.



### FLEXIBLE METAL HOSE

Isolation of vibration is easy and economical when you use CMH Metal Hose to connect rigid piping to machinery.

Metal hose assemblies are quickly installed, just like a length of pipe. The flexibility of the unit effectively absorbs vibration while the all-metal construction assures long, dependable service.

If you have a vibration problem in your piping it will pay you to consider CMH Flexible Metal Hose. Your Flexonics distributor can give you full information. Look for his name in your classified telephone directory.

Flexonics

EXPANSION JOINT DIVISION
Orporation 1317 S. THIRD AVENUE · MAYWOOD, ILLINOIS

FORMERLY CHICAGO METAL HOSE CORPORATION -

Flexon identifies products of Flexonics Corporation that have served industry for over 50 years.



Manufacturers of Convoluted and Corrugated Flexible Metal Hose in a Variety of Metals - Expansion Joints for Piping Systems - Stainless Steel and Brass Bellows - Flexible Metal Conduit and Armor - Assemblies of These Components In Canada: Flexonics Corporation of Conada, Ltd., Brampton, Ontario

# PUT UP TO STAY UP!



THAT **GRID** UNIT HEATER'S BEEN UP 16 YEARS AND IT STILL DOESN'T NEED REPAIRS!

That's the statement of a large eastern chemical plant. Their letter to us continues: "We have found that cast iron construction stands up very well against the corrosive fumes of HC \( \ell \), C\( \ell \), etc. ... the unit heaters that have copper tubes give trouble due to corrosion in a few years ... we consider GRID Unit Heaters satisfactory and would certainly recommend them for installation where corrosive acid fumes exist". Such service record occurs because GRID is completely different from other unit heaters — here's how:

- GRID is an all cast unit with finned heating sections and headers tested to withstand steam pressures up to 250 # P.S.I.
- GRID construction uses no brazed, soldered, rolled or welded connections between condenser and headers. A specially designed threaded nipple assures a precision, leakproof fit.
- GRID construction has all similar metals in contact with steam thus preventing electrolytic corrosion which eventually occurs in copper type unit heaters where steam passes from iron pipes into copper cores. (Write for booklet CORROSION IN UNIT HEATERS).
- GRID construction resists corrosion from corrosive acid fumes that exist in chemical plants.
- GRID design incorporating low outlet temperatures, proper fan sizes and motor speeds, assures delivery of warm comfortable air in ample volume to the working level. No stratification of warm air at the ceiling to waste your fuel dollars.



GRID BLAST COILS ARE IDEAL FOR MANY USES THROUGHOUT CHEMICAL PROCESSING INDUSTRIES — WRITE FOR CATALOG BC-1049.

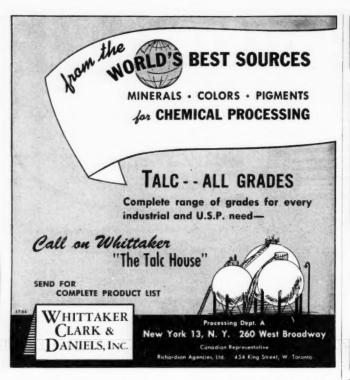
These are the reasons why users of GRID Unit Heaters get 16 years and more of trouble-free service. There are units cheaper than GRID, but there are none better.

You start saving money the day you install GRID Unit Heaters.

REPRESENTATIVES IN PRINCIPAL CITIES

D. J. MURRAY MANUFACTURING CO.

WAUSAU, WISCONSIN



# Complete Acid-proofing Service

EL-CHEM offers complete service covering every type of acid-handling and storage unit — and every kind of corrosive • EL-CHEM construction withstands thermal and mechanical shock • With more than thirty-five years experience, reflected in installations in the largest chemical and steel plants, we have developed many new proofing materials and more efficient methods of application • We maintain an active research department and our engineers are ready to survey your acid-proofing problem, make recommendations and prepare plans and estimates — without obligation • EL-CHEM Materials include CEMENTS, BRICK, LININGS, COATINGS, IMPERVIOUS MEM BRANES, PIPE JOINTING MATERIALS, etc., etc., used in constructing TANKS, TOWERS, FLOORS, STACKS, DUCTS, SEWERS, GUTTERS, WASTE LINES and NEUTRALIZING EQUIPMENT • EL-CHEM Service includes materials and supervision — or complete installation • Write for technical bulletin



Scrubbing tower handling hydrochloric acids and solvents at 280° F., 40 p.s.i. steel shell, Duro-Line membrane, Lecite joined brick lining.

Part of 25,000 sq. ft. of floor. EL-CHEM Lecite and glass cloth membrane under 1%" floor brick joined with





ENGINEERING &
MANUFACTURING CO.

752-B Broad Street • Emmaus, Pa.

Manufacturers of acid and alkali-proof cements, linings and coatings since 1912

# TANKOMETER FOR MEASURING TANK

FOR MEASURING TANK
CONTENTS ANY DISTANCE AWAY



TANK MAY BE BURIED, ELEVATED, OPEN, CLOSED, VENTED OR UNDER PRESSURE OR VACUUM



ALSO ...

#### **HYDROSTATIC GAUGES**

FOR ALL PURPOSES

PRESSURE • VACUUM • DRAFT

DEPTH & ABSOLUTE PRESSURE

DIFFERENTIAL PRESSURE

MERCURIAL BAROMETERS

SEND FOR BULLETINS

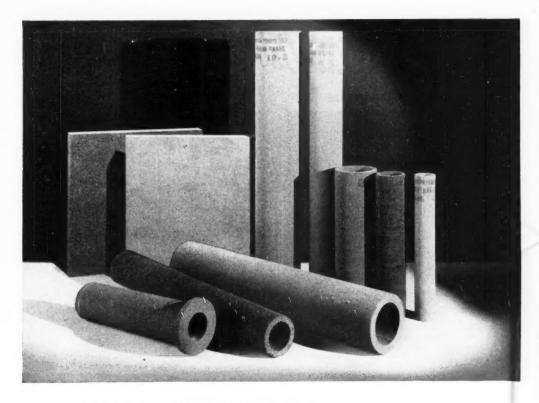
UEHLING INSTRUMENT CO.



Worklon Industrial Apparel RESIST ACIDS AND CHEMICALS Outwear cotton and wool 13 to 1

they're DuPont Orlon new acrylic fiber; fabric by Travis





# For greater filtration efficiency, easier cleaning operation . . .

### Norton ALUNDUM\* Seamless Tubes

Increase the efficiency of your filtration system with Norton porous seamless tubes. Made of long lasting ALUN-DUM grain, their seamless construction assures more uniform filtration and faster, more thorough cleaning by backwashing.

Used in systems filtering water, solvents, cutting oils, wine, food oils, and other liquids . . . in reclaiming cleaning fluids, industrial waste . . . in swimming pool filtration, and boiler feed water treatment.

Norton porous mediums, in both tube and plate forms, bring you chemical stability unaffected by most corrosive acids, strength that assures maximum resistance to breakage and chipping... controlled structure (an exclusive Norton process) that permits positive

control over grain spacing and predetermined pore size and open pore ratio to meet your requirements.

#### Send for Bulletin No. 140

Plan now to get complete data on these Norton refractory products by obtaining Norton Bulletin No. 140:

\*Trade-Mark Reg. U. S. Pat. Off. and Foreign Countries

"Norton Porous Mediums." Ask your Norton representative for a copy or write us direct. NORTON COMPANY,

506 New Bond St., Worcester 6, Mass. Canadian Representative: A. P. Green Fire Brick Co., Ltd., Toronto, Ontario.



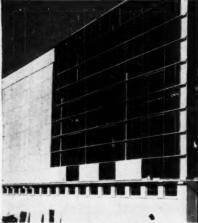
NORTON

### POROUS MEDIUMS

Making better products to make other products better NORTON COMPANY, WORCESTER 6, MASSACHUSETTS

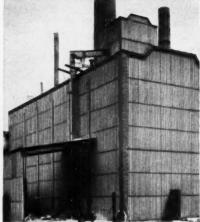
# CORRUGATED Oubestos TRANSITE\*

#### **For Fast Construction**



This "under construction" view of a recently completed aircraft plant clearly demonstrates how Johns-Manville Corrugated Transite goes up quickly and easily with a minimum of framing.

#### **For Rugged Service**



This railroad boiler house, built of rugged Johns-Manville Corrugated Transite, is still serviceable and presentable despite many years of heavy exposure to steam, smoke and soot.

### You build economically and quickly with these versatile fireproof and weatherproof asbestos building sheets

In the past quarter century, Johns-Manville Corrugated Transite has proven an ideal material for roofs and for sidewalls of industrial, commercial, institutional and agricultural buildings. Made of asbestos and cement, the large sheets are easy to handle, go up quickly with a minimum of framing. Practically indestructible, Corrugated Transite is fireproof, rotproof, weatherproof, needs no paint or special treatment to preserve it, and can be salvaged and re-used if necessary.

Today, Corrugated Asbestos Transite is also used increasingly for smart interiors...the streamlined corrugations and attractive shadow lines that give it such unusual architectural appeal for exteriors offer unlimited interior design possibilities.

Investigate J-M Corrugated Asbestos Transite and learn how you can build quickly and easily . . . have an attractive, long-lasting, troublefree structure regardless of size or purpose. For complete details write Johns-Manville, Box 158, Dept. CE, New York 16, N. Y. In Canada write 199 Bay Street, Toronto, Ontario.



EASY TO FASTEN TO STEEL





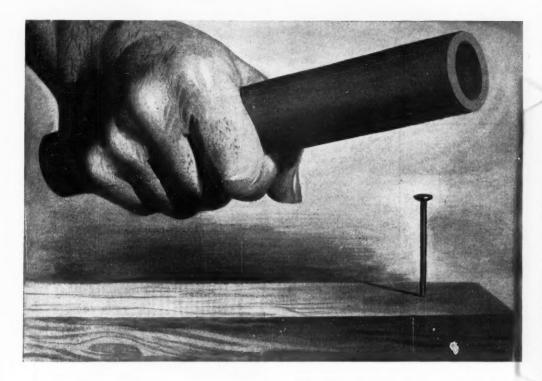




Johns-Manville Asbestos

CORRUGATED TRANSITE

# So tough you can drive a nail with it!



## USCOLITE...U. S. Rubber's famous plastic

This plastic pipe is unbeatable in impact strength. For example, a .44 cal. revolver bullet, fired at a distance of 20 yards, scarcely dented a section of Uscolite piping. This remarkably strong and versatile plastic is resistant to most industrial chemicals. It is lightweight, easy to handle.

Furnished in standard lengths, Uscolite pipe can be cut and threaded with standard equipment. A complete line of Uscolite fittings is also available, enabling contractors to do a complete on-the-job assembly and installation. For further information, write to address below.



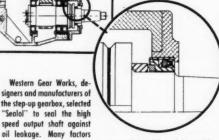
UNITED STATES RUBBER COMPANY



When Slo-Mo-Shun IV set a new world's hydroplane record of 178.497 miles per hour, a "Sealol" Rotary Shaft Seal was on board for the ride. To drive the boat at such a terrific speed, the full

power of an Allison V-12 aircraft engine is transmitted through a 3:1 step-up gear box, driving the propeller shaft at speeds in excess of 12,000 rpm.

Assembly drawing of the Sto-Mo-Shun gearbox.



influenced this selection. Compactness, lightweight, minimum frictional drag, ability to withstand ultra-high shaft speeds — these are the major reasons why "Sealol" was chosen for the job.

While Mr. Stanley Sayres has been setting speed records with Slo-Mo-Shun IV, "Sealol" has been setting performance records in shaft sealing . . . pressures in excess of 1000 psi — or temperatures of 600° F. — or rubbing speeds of 16,000 linear ft. per min. . . . demonstrate some of the unusual performances possible with "Sealol" Seals.

Perhaps your unusual problem can be solved by Sealol. Send blueprints and specifications to our engineering department at Sealol Corporation, 45 Willard Ave., Providence 5, R. I. Plants Nos. 3 and 2 in Providence. Plant No. 3 in Keene, N. H. Offices in Philadelphia, Cleveland, Chicago, Los Angeles, Montreal, Toronto.

# SEALOL

The Balanced Pressure Seal







Get

something extra

when you buy

# lead valves

New York 6; Atlanta; Baltimore 3; Buffalo 3; Chicago 8; Cincinnati 3; Cleveland 13; Dallas 2; Philadelphia 25; Pittsburgh 12; St. Louis 1; New England: National Lead Co. of Mass., Boston 6; Pacific Coast: Morris P. Kirk & Son. Inc., Los Angeles 25. Emeryville 8 (Calit.), Portland 15. Seattle 4; Canada C. acta (Canada Metal Co., Ltd., Toronto 8, Montreal, Winnipeg, Vancouver.



Do you look for sturdiness, dependability, and suitability in the lead valves you buy?

Do you expect valve type, size, pattern and flanging to meet your acid handling equipment specifications?

Of course you do! And when you order National you get what you look for. You get what you expect. And you get certain "extras" besides...extras that spell highest quality.

For example, the lead used is the grade acknowledged best for acid-handling—St. Joe Chemical Lead. Furthermore, National Lead valves have precision, lathe-turned stems. They have full flow-ways. They're designed to permit repacking in service. And they have positive plug-seat fit.

Fabrication extras... design extras... quality extras... Yes! And these extras you get, but never need specify, add up to outstanding service on the job.

That's why it pays to buy National valves'... for something extra in lead.

Lead valves

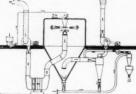
with a NATIONAL reputation
LEAD COMPANY

# Have a Drying Problem?

### ...use Nerco-Niro Spray Dryers\*

The experience gained through more than 250 Spray Dryer installations throughout the world is at your service. Let us solve your chemical drying problems.

At right: Typical Nerce-Niro Spray Dryer Flow Diagram.



Nerco-Niro Spray Dryers offer to the chemical industries the following features:

- 1. Maximum solids recovery.
- 2. Product quality and uniformity.
- 3. Gentleness of drying.
- Low maintenance and labor cost. Ease of cleaning.
- 5. Low consumption of power and heat.

Every industrial Spray Dryer installation is individually engineered.

At right: Portable 34" Nerco-Nire Spray Dryer.





\* Patented

Laboratory facilities available for test purposes.

NICHOLS ENGINEERING & RESEARCH CORP.

NERCO-NIRO SPRAY DRYER DIVISION 70 Pine Street, New York S. N. Y.

INDIANAPOLIS

PASADENA

MONTREAL

### Wilsonize

to get tubular equipment back on the line faster



One good way to save money is to speed-up tube maintenance. That's the job for these economy "specialists" . . . Wilson Tube Cleaners and Expanders. When you Wilsonize, you beat the clock on downtime . . . get equipment back on the line faster. Here's why:

Wilson Tube Cleaners handle every kind of deposit—hard or soft, thick or thin, or variable in depth. Powerful, fast-acting, they make quick work of cleaning straight or curved tubes from ½" to the largest ever cleaned. Wide range of cutter heads and accessories available.

Wilson Tube Expanders are designed to give the smooth, efficient rolling action which insures firm seating of the tube . . . provides perfectly rolled joints . . . reduces time-wasting rerolling and re-inspection. They are made of the highest quality steel, heat-treated for long service life.

Yes, Wilsonize to economize. Follow the lead of thousands of industrial plants throughout America. Send for 48-page Bulletin on complete Wilson Tube Cleaner line and for Tube Expander Catalog. A single request brings both.



TW 798

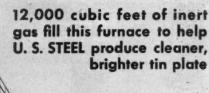
Representatives in all principal cities

THOMAS C. WILSON, INC.

21-11 44th AVENUE, LONG ISLAND CITY 1, N. Y.

WILSON

**TUBE CLEANERS • TUBE EXPANDERS** 



5 Lectrodryers\* DRYthat gas

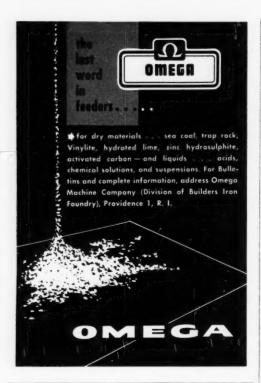
Strip is only in this furnace about 105 seconds: 20 seconds in the heating zone, 15 seconds in the holding zone, 15 seconds for slow cooling and then into the rapid cooling zone.

30 tons of tin plate per hour! That's the production pushed through this tower-type annealing furnace at U. S. Steel's Sheet and Tin Mill in Gary. And the strip comes out uniformly annealed, flat, clean and bright. The DRY protective atmosphere that fills the furnace assures that brightness. Two blowers recirculate this gas, creating considerable turbulence to accelerate heat transfer, Five Lectrodryers keep the gas DRY. To men having trouble with unwanted moisture in air, gases or organic liquids, Lectrodryer engineers offer their services. Write Pittsburgh Lectrodryer Corporation, 303 32nd Street, Pittsburgh 30, Pennsylvania.

Furnace built by General Electric Company, with the co-operation of Surface Combustion Corporation.

LECTRODRYERS DRY
WITH ACTIVATED ALUMINAS

**LECTRODRYER** 





A complete steam plant backed by undivided responsibility • Shipped completely assembled • More than 80% thermal efficiency quaranteed • 4-pass design provides 5sq. ft. of heating surface per b.h.p. • Built-in induced draft eliminates need of expensive chimney • Simple installation • Clean, quiet operation • Heavyduly construction assures long-lived duty construction assures long-lived descriptions and lived descriptions and lived descriptions are described as a lived described des

dependability
For complete details, write for Catalog 322

ENIOR COMBUSTION INDUSTRIE

Factory: Emmous, Pa.

Esec. Ollices: Times Bidg, Times Sq., New York N. Y

STEAM GENERATORS

## MERIAM INSTRUMENTS FOR INDUSTRY

For 37 years we have been solving measurement problems by supplying standard or special instruments to accurately measure pressures, vacuums and flows of liquids and gases. We have constantly improved, devel-

oped and diversified the line so as to meet fully all needs of the field.

#### U-TYPE MANOMETERS

The Clean-Out Manometer (at left) for line pressures up to 100 lbs. per sq. in. A wing nut permits the Manometer body and tube to be disconnected from the head—the tube cleaned with a brush furnished or tube replaced, and the instrument reassembled without disconnecting the head section from the piping. Send for Bulletin No. 1.

The Model A-995 WM Manometer for line pressures up to 400 lbs. per sq. in. These instruments are built with heavy walled annealed straight Pyrex tubes, gland packed top and bottom in steel end blocks and clamped to the body at fixed intervals to prevent distortion. Catalog Sheet A-995 WM gives complete details.

#### **WELL-TYPE MANOMETER**

Model A-275 WM (at left) is a direct reading type for line pressures up to 150 lbs. per sq. in. Standard construction; ranges—from 6" to 24". Wall mounted type shown; also available in flush mounting. Ask for Catalog Sheet A-275 WM.

#### SIGHT FEED BUBBLER

This Sight Feed Bubbler with 21/4" dia. bowl of Pyrex glass is good for line pressures up to 50 lbs. per sq. in.; of plastic, for pressures up to 100 lbs. Sturdily built with brass or semi-steel body. Supplied in ring type (shown) and strap type. Needle valve controls bubbler rate. Ask for Bulletin 21.



THE MERIAM INSTRUMENT CO.



MANOMETERS, METERS AND GAUGES FOR THE ACCURATE MEASUREMENT OF PRESSURES, VACUUMS AND FLOWS OF LIQUIDS AND GASES

CLASS 50

Dust-tight, all-electric, high-speed, accuracy-indicating scale for weighing dry, ground, granular, dusty, nonfree-flowing and some small lumpy materials, Bulletin 3649.



CLASS 38 Dust-tight, heavy-duty scale for dry, ground, dusty, non-freeflowing materials. Bulletin 8946.



CLASS 40

Accommodates screw, vibrating feeder for handling wide range of materials. Dusttight, solenoid- or motor-operated discharge, accuracy-indicat-ing, Bulletin 1449.



CLASS 39

Self-contained, dust-tight, belt-feeding and weighing unit. Accuracy-indicating for process or intermittent batch weighing of lumpy, crushed, sluggish ma-terials. Bulletin 1549.

# what can WE do for YOU Mr. Processor

Frankly, that's the reason we're running this ad-not to tell you about our products, but to ask you about your plant problems. Because if your business involves the handling of any materials or liquids by weight, we think you probably have an operation or two which just doesn't measure up in efficiency, economy, or speed. We'd like to know about it, because we think we can help.

You can call it pride, or conceit, or self-satisfaction, or self-confidence, but our engineers have never been stumped for long by a problem in materials-handling by weight-and in fifty years of working with the biggest names in American industry we've seen a lot of them! From aluminum sulphate, to zinc oxide, and back to almonds we've successfully installed Richardson units or systems to handle just about everything in the book, and built a lot of goodwill and a fair-size company in the process.



CONTROL PANEL

Richardson-designed panels such as this control whole automatic weighing systems composed of scales like those at the left.

Naturally, if a Richardson Scale can contribute to the smoother, faster, or more profitable opera-tion of your plant, we'd like to sell you one. We think that our products and experience can help in solving your problem in processing, and if you'll outline it, we'll be glad to have one of our field

engineers arrange to go over it with you.

Or, if you'd just like to know more about Richardson Scales for possible future reference, simply clip this ad to your signed letterhead and mail. Bulletins 0450, 0550, and 0351 will be sent you by return mail-no obligation.

The Richardson Scale Company, Clifton, N. J., will be glad to supply information on:

Feeder-Weigher Systems . Automatic Bulk Weighing Hopper Scales • Automatic Bagging Scales • Bag Sewing Conveyors
Packers • Process Control Panels and Select-O-Weigh

Please write direct to our Clifton office, or to the nearsets of our branch offices located in Atlanta, Boston, Detroit, Minneapolis, Cincinnati, Wichita, Montreal, Omaha, New York, Pittsburgh, San Francisco, Toronto, Buffalo, Chicago, Philadelphia, Houston, St. Louis.





CLASS 56

Self-checking, automatic feederweigher for large tonnage; practically continuous stream delivery. Beam system has approval of all weighing authorities. Bulletin



SELECT-O-WEIGH

On electronic weight con-trol system providing remote, instantaneous, dial-control formula changing and ingredient selection for all proportioning applications. Bulletin 0351.



# doing the job 9 ways Better



When a Mid-South insecticide manufacturer installed Sprout-Waldron Intimate Blending Equipment two years ago, a better, more effective product was the prime consideration. This leading agricultural dust producer (name on request) knew all the advantages of perfect blending over old-fashioned mixing.

But Sprout-Waldron engineering skill gave this company, like so many others, MORE than a better product. Sprout-Waldron Intimate Blending Equipment proved itself 9 ways better! This customer reports the installation:

- 1. Improved product quality 5. Cut maintenance cost
- 2. Increased efficiency
- 3. Saved labor
- 4. Reduced operating costs

- 6. Removed dust hazards 7. Improved sanitation

8. Operated more quietly 9. Improved working conditions

You get more when you specify Sprout-Waldron Intimate Blending Systems. Installation after installation proves this fact...in hard, cold, profit dollars.

Sprout-Waldron specialists can advise you on improving your product, safeguarding your personnel, boosting production and increasing your profits. Write for Bulletin I-846 today! Address Sprout, Waldron & Company, Inc.,15 Logan Street, Muncy, Pennsylvania.



PROUT-WALDRON

The Best in PROCESSING EQUIPMENT Since 1866



reduce operating cost of analysis.

Use Dietert-Detroit Carbon and Sulfur Determinators for Economical Analyses Write to Dept. CE-1 for descriptive literature



# A PROVED IMPROVEMENT FROM PEERLESS



Type

REFINERY AND **EMICAL PROCESS** 

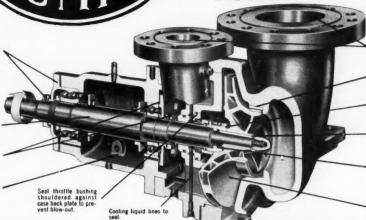
Stinger and special re-cessed bearing cap provide an effective seal without wearing

Heavy duty thrust and radial bearings oil-lubricated.

Precision alloy steel, heat-treated, shaft.

Stinger and special re-cessed bearing cap provide an effective seal without wearing parts.

Extra large capacity oil



Top suction and top discharge design. End-suction design avail-able.

Case and impeller wearing rings are spot electric welded.

Mechanical shaft seal assembly.

Lock washer secures hex nut on shaft.

Seal sleeve keyed to shaft, gasketed at shaft shoulder to prevent leakage under sleeve.

Enclosed type impeller is keyed to shaft; re-pelling vanes on back shroud.

## **ONLY PEERLESS PUMP OFFERS** THIS HEAVY DUTY PROCESS PUMP-

designed with and for a MECHANICAL SHAFT SEAL

SHAFT SEAL DESIGN PERMITS USE OF SHORT, SHAFT WHICH MEANS LESS DEFLECTION, GREATER RIGIDITY, MINIMUM RUN-OUT, LESS WEAR IN BEARINGS, WEAR RINGS, SEAL AND MOVING PARTS...A first from Peerless! This heavy duty, center-line-mount pump designed with and for a mechanical shaft seal also has many other advantages including: GREATER SAFETY: Throttle bushing is shouldered against case back plate from suction side; cannot blow out even under maximum operating pressure. GREATER ECON-OMY: No premium is charged in first cost for the mechanical shaft seal construction of the Type PRS pump. Lower maintenance costs will be effected throughout its longer life. AVAILABILITY: Peerless Type PRS pumps are available for quick assembly and shipment from Peerless' Los Angeles stock in several sizes.

#### PEERLESS PUMP DIVISION

FOOD MACHINERY AND CHEMICAL CORPORATION Address inquiries to Factories at:
Los Angeles 31, California, and Indianapolis 8, Indiana
Offices: New York, Atlanta, Chicago, St. Louis, Phoenix, Fresno, Los Angeles,
Dallas, Plainview and Lubback; Texas; Tulsa, Albuquerque, N. M.
Distributors in Principal Cities; Cansult your Telephane Directory.

#### USE IT FOR PUMPING

All petroleum hydrocarbons, process liquids, hot oil, water, at elevated temperatures and pressures. Liquid end case can be furnished in material suitable to the service.

#### HERE ARE ITS CHARACTERISTICS

Copacities: up to 1000 gam Operating Heads:

Temperatures:

up to 625 feet Case Pressures: up to 400 psig

> up to 250° F Drives: horizontal electric mater is standard: other types available as required.

#### WRITE FOR INFORMATION

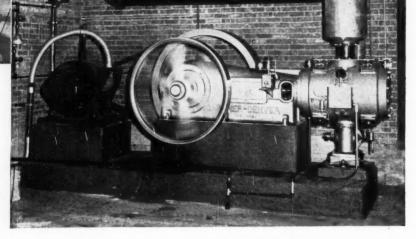
PEEPLESS PHAP DIVISION FOOD MACHINERY AND CHEMICAL CORPORATION 301 West Avenue 26 Los Angeles 31, California

Please send us information on the Type PRS pump.

Company

City. State CHEM ENG

# Unrestricted Flow



Gardner-Denver RX Single-Stage Compressors are made in a wide range of sizes to assure the right pressure and capacity for your needs.

# ...another reason why GARDNER-DENVER R X compressors save you money!

Free and easy! That's the way air flows through the large, unrestricted valve and port areas in the Gardner-Denver RX Compressor. That means the RX uses less power to supply the compressed air you need—and there you have one of the big reasons

why an RX costs less to operate.

Other money-saving RX features include the dust-tight, heavy-duty power end—automatic lubrication—and "Air-Cushioned" Duo-Plate valves. Write today for additional information.

SINCE 1859

# **GARDNER-DENVER**

Gardner-Denver Company, Quincy, Illinois
In Canada: Gardner-Denver Company (Canada), Ltd., Toronto, Ontario

THE QUALITY LEADER IN COMPRESSORS, PUMPS AND ROCK DRILLS



was offered by Penflex engineers.

Today, this large New England storage center has no trouble with pipe breakage. A length of 12" I.D., four-wall interlocked specially packed Penflex tubing was installed with tight-packed flanges. No amount of settling of the tank or thermal expansion causes breakage of connections. The easy flexing Penflex "walks" with the tank . . . yet maintains a tight leak-proof connection at all times. Leakage has been eliminated . . . fire

Let Penflex engineers help you on flexible tubing application problems. Penflex manufacturers a complete line of four wall, interlocking and seamless welded corrugated flexible tubing . . . metallic hose, tubing or couplings from 1/8" I.D. and up . . . automatic barrel fillers, pneumatic rivet passers, accessories and fittings. Write for folder "Flexineering," a valuable production aid.

Pennsylvania Flexible Metallic Tubing Company, Inc., 7234 Powers Lane, Phila. 42, Pa. Branch Sales Offices: Boston . New York · Chicago · Houston · Cleveland · Los Angeles





You could know the plant...20 years of steady growth ...20 years of work, brains and money...then in 20 minutes a little fire got away and reduced it all to nothing.

But, your larger size fire hazards can be protected very efficiently at a reasonable cost, thanks to C-O-TWO Low Pressure Carbon Dioxide Type Fire Extinguishing Systems. Simple piping, running from one centrally located storage tank, instantly transports clean, non-damaging, non-conducting carbon dioxide anywhere in the plant area...to flammable liquids, electrical equipment, storage spaces, manufacturing processes and record vaults. Fire at any protected location is extinguished in seconds with an absolute minimum of expense and interruption.

Flexibility is the keynote with these C-O-TWO Fire Extinguishing Systems . . . the low pressure carbon dioxide

storage tanks range in capacities from one to fifty tons... discharge facilities can either be manual mechanical, manual electric, automatic mechanical, automatic electric or a combination of these... especially installed to fit your particular needs. Future plant expansion is easily and economically provided for by initially installing an oversized low pressure carbon dioxide storage tank and adding the supplementary discharge facilities at a later date.

Whether it's fire detecting or fire extinguishing . . . portables or built-in systems . . . C-O-TWO means experienced engineering that assures you of the best type equipment for the particular fire hazard concerned.

#### WHEN BUSINESS STOPS . . . INCOME STOPS!

Don't take chances with your investment. Secure the benefits of highly efficient fire protection engineering today . . . our extensive experience over the years is at your disposal without obligation. Get the facts now!



#### MANUFACTURERS OF APPROVED FIRE PROTECTION EQUIPMENT

Squeez Grip Carbon Dioxide Type Fire Extinguishers Dry Chemical Type Fire Extinguishers Bull-In High Pressure and Low Pressure Carbon Dioxide Type Fire Extinguishing Systems Built-In Smoke and Hear Fire Detecting Systems

#### C-O-TWO FIRE EQUIPMENT COMPANY

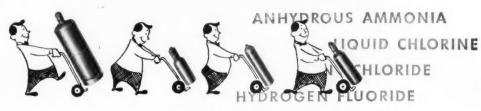
NEWARK 1 . NEW JERSEY

C-O-TWO FIRE EQUIPMENT OF CANADA, LTD. . TORONTO 8 . ONTARIO

Sales and Service in the Principal Cities of United States and Canada

AFFILIATED WITH PYRENE MANUFACTURING COMPANY









# for shipping any type of gas SAFELY and at LOWER COST!

Choose Hackney Cylinders—and be sure your products are fully protected both in transit and in storage. Rugged Hackney Cylinders are deep drawn from quality metals. Skillful fabrication and controlled heat-treating add still further to their strength and durability.

Choose Hackney Cylinders—and save money on your shipping and handling costs. Designed for safe handling and for convenient filling and emptying, Hackney Cylinders are light in weight. Correct design, high strength materials and uniform wall thicknesses all help eliminate excess weight—save money for you on every shipment you make.

Each one of these strong, lightweight Hackney Cylinders is specially designed for a particular type of gas. Each one is made from the most suitable metal—to exacting specifications developed through our long and intimate experience with the properties of metals and gases. Write for full details.

# **Pressed Steel Tank Company**

Manufacturer of Hackney Products

1447 S. 66th St., Milwaukee 14 • 1325 Vanderbilt Concourse Bldg., New York 17 203 Hanna Bldg., Cleveland 15 • 936 W. Peachtree St., N.W., Room 113, Atlanta 3 208 S. LaSalle St., Room 792, Chicago 4 • 553 Roosevelt Bldg., Los Angeles 17

CONTAINERS FOR GASES, LIQUIDS AND SOLIDS



The ability of Nash Compressors to maintain original performance over long periods is no accident. Nash Compressors have but a single moving element, the Nash Rotor. This rotor is precision balanced for long bearing life, and it revolves in the pump casing without metallic contact. Internal lubrication, frequent cause of gas contamination, is not employed in a Nash. Yet, these simple pumps maintain 75 lbs. pressure in a single stage, and afford capacities to 6 million cu. ft. per day in a single compact structure.

Nash Compressors have no valves, gears, pistons, sliding vanes or other enemies of long life. Compression is secured by an entirely different principle of operation, which offers important advantages often the answer to gas handling problems difficult with ordinary equipment.

Nash Compressors are compact and save space. They run without vibration, and compression is without pulsation. Because there are no internal wearing parts, maintenance is low. Service is assured by a nation-wide network of Engineering Service offices. Write for bulletins now.

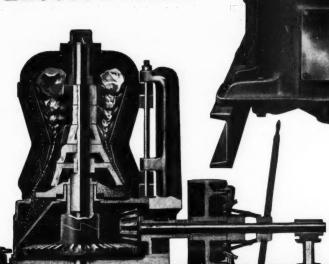
No internal wearing parts. No valves, pistons, or vanes. No internal lubrication. Low maintenance cost. Saves floor space. Desired delivery temperature Automatically maintained. Slugs of liquid entering pump will do no harm.

75 pounds in a single stage.

NASH ENGINEERING COMPANY
312 WILSON, SO. NORWALK, CONN.



Grush or
Granulate
to Fine, Even
Sizes without
Excess Dust...



Cross section view illustrating the crushing action

These rugged crushers speed output of fines, cut reduction costs. Desired fineness is quickly obtained by regulating hand wheel. "Open-door" accessibility permits fast, easy cleaning. They crush fine . . . crush fast and do not clog. Available in output capacities from 1 to 30 tons-per-hour. Write for catalog.

#### STURTEVANT MILL COMPANY

100-A CLAYTON STREET, BOSTON 22, MASSACHUSETTS

Designers and Monufacturers of: CRUSHERS • GRINDERS • SEPARATORS • CONVEYORS

MECHANICAL DENS and EXCAVATORS • ELEVATORS • MIXERS

#### CLIP AND MAIL COUPON TODAY

Sturtevant Mill Company 100-A Clayton Street

Boston 22, Massachusetts Gentlemen:

Please send me catalog describing your Rotary Fine Crushers. I am interested in crushing

Name

Stre

City & State

Firm



# We help make 'em cold for hot service

At a Houston, Texas, plant operated by the Goodyear Synthetic Rubber Corporation for the R. F. C.'s Synthetic Rubber Division, it's Worthington equipment that helps maintain the required brine temperatures, ranging from 13 to 17 F, in the manufacture of "cold rubber".

Goodyear developments have done a lot to improve serviceability of cold rubber for tires, particularly for use on military vehicles.

The list of names that have joined them in selecting Worthington refrigeration includes: U. S. Rubber Co., Firestone Tire and Rubber Company, General Tire and Rubber Company, Minnesota Mining and Manufacturing Co., Ford Motor Company, General Aniline and Film Corp., North American Aviation Company, Celanese Corporation of America, Tidewater Oil Co., Rohm & Haas.

# Investigate more worth with Worthington

For air conditioning or refrig-

eration, call upon Worthington... you'll benefit from an unequalled experience serving industrial and commercial applications.

The complete line of Worthington refrigeration equipment includes vertical (1 to 150 tons), Y-type (150 to 450 tons) and horizontal ammonia compressors (50 to 1,000 tons); Freon compressors (3 to 125 tons); centrifugal compressors (to 2,600 tons); gas-engine compressors, chillers, exchangers, condensers, pumps and other auxiliary equipment.

No other manufacturer makes so complete a line. A Worthington system is all Worthington-made not just Worthington-assembled—assuring you of perfectly balanced operation and unit responsibility

Consult your local Classified Telephone Directory for the Worthington distributor that is nearest you or write to Worthington Corporation, Air Conditioning and Refrigeration Division, Harrison, New Jersey.



FOUR WORTHINGTON LTC-3 GAS ENGINE AMMONIA COMPRESSORS at Houston plant operated by Goodyear for the R. F. C.'s Synthetic Rubber Division. Units are rated 400 BHP at 320 rpm. They chill 24% calcium chloride brine down to desired 13 to 17 F range. Other Worthington equipment at the installation includes brine coolers, condensers and brine pumps.

\*Reg. U. S. Pat. Off.

A.2.3



\*Reg. U. S. Pat. Off.

# Benzol Products Co. solves tough vacuum problem with Worthington Steam Jet Ejectors

18 units installed since 1942 for operation under extremely corrosive conditions

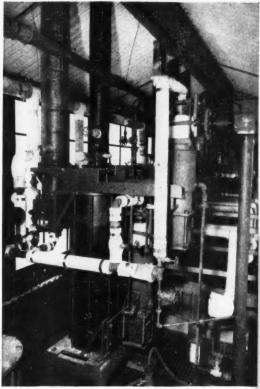
Benzol Products Company of Piscataway, New Jersey, had a real problem on their hands.

Until 1942, they were having extreme difficulty with maintenance and operation of their vacuum pumps due to the highly corrosive vapors resulting from their processes. In 1942, they replaced a vacuum pump with a Worthington corrosive resistant ejector, and it was so successful that they have now replaced all of the vacuum pumps for corrosive service with ejectors. Some of the units installed in 1942 and 1943 are still equipped with their original nozzles and diffusers—in spite of 24 hour-a-day, 6-day-a-week operation.

Corrosion—the one big problem—has been eliminated by the material from which these particular ejectors are made—impervious graphite.

Worthington's experience with ejectors dates back to 1918. And today, there's a Worthington model for every vacuum requirement—from atmosphere to 50 microns absolute, single and multiple stages, condensing and non-condensing, of stainless, bronze, porcelain, impervious graphite, Worthite, cast iron and steel.

Write and tell us about your specific requirements. Worthington Corporation, Steam Power Division, Ejector Section, Harrison, New Jersey.

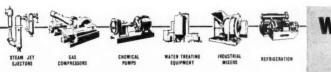


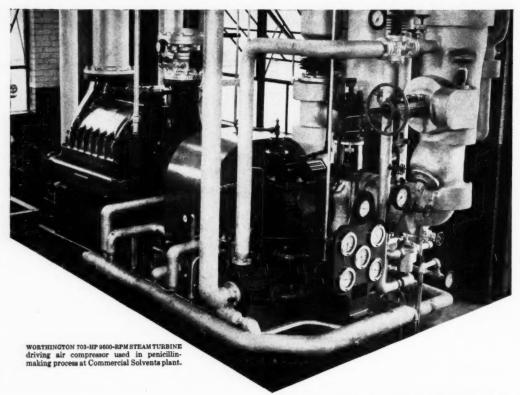
WORTHINGTON STEAM JET EJECTOR MADE OF IMPERVIOUS GRAPHITE for corrosion resistance. Installation at Benzol Products Company plant in Piscataway, New Jersey, used on vacuum service in production of synthetic allethrin. This three-stage unit operates at 2 mm Hg absolute.

#### 6 Big Advantages of Steam Jet Ejectors for Vacuum Service

- 1. Initial cost is low.
- 2. Operating costs are at a minimum.
- 3. Maintenance costs are negligible.
- 4. There are no moving parts.
- 5. Easy to operate.
- They can be manufactured of any machinable material.

× 2 3





9600-rpm turbine drives compressor in making penicillin for Commercial Solvents Corp.

Two years ago, a Worthington high-speed steam turbine was installed in the Terre Haute, Indiana, penicillin plant of Commercial Solvents Corporation. Its high efficiency and economical steam consumption plus its low maintenance demands have justified that selection many times over.

In addition, use of Worthington high-speed, directdrive turbines to drive centrifugal compressors or blowers makes possible a broad speed range, elimination of costly speed increasing gears, and adaptability to various governing arrangements for precise control under all operating conditions. Worthington's design flexibility provides you with the right type and size turbine for optimum performance-regardless of your requirements.

Remember, when you're considering turbines for driving compressors, the engineering of the turbine is just as important as the engineering of the compressor. Worthington's long and complete experience in compressor-drive engineering is your assurance of maximum efficiency. Write for Bulletin 1966 to Worthington Corporation, Steam Turbine Division, Wellsville, N. Y.















A GREAT TEAM IN STEAM

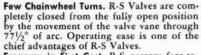




EXCERPTS FROM THE R-S BOOK OF EXPERIENCE

# For Operating Ease in Inaccessible Locations

# INSTALL R-S CHAINWHEEL VALVES



Economy in First Cost. R-S narrow face-toface design results in minimum number of working parts, less metal, less machining, lower weight and less supporting structure hence economy in first cost.

Accurate Engineering. Body assemblies are accurately engineered mechanically and metallurgically. A. S. A. standards are equaled or exceeded in every detail.

Low Pressure Drop Saves Power. In the open position the streamlined vane causes a Venturi action. Pressure drop is therefore exceptionally low. Pumping costs are reduced accordingly.

More Control Rangeability. Power-controlled prime movers delivering 15 foot-pounds to 38,000 foot-pounds of torque open or close at any desired speed. Full closure requires one second to ten minutes depending on requirements and the type of material controlled. Positive shut-off is obtained with a rubber seat.

Self-cleaning. There are no pockets to house sediment, no change of flow direction to create turbulence or wire drawing and therefore less likelihood of erosion and cavitation.

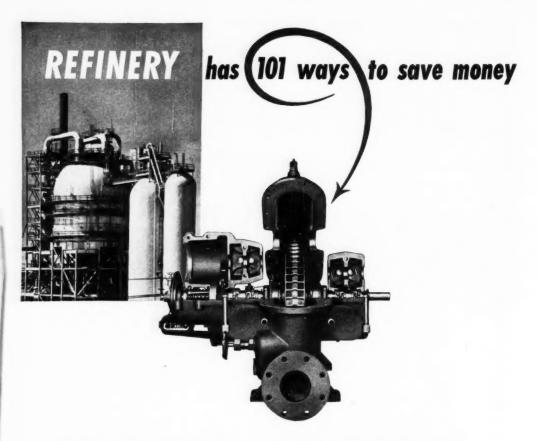
Maintenance Practically Nil. Every R-S Valve is designed and constructed for rugged service and provided with safety factors to give complete satisfaction in the service for which it is designed. Packing trouble is not common to R-S Valves since the shaft moves only with an oscillating motion.

Consult your local R-S Valve Engineers, or write direct.

R-S PRODUCTS CORPORATION • 4600 Germantown Ave., Philadelphia 44, Pa.

An S. Morgan Smith Company Subsidiary

DISTRICT OFFICES IN PRINCIPAL CITIES



When the yearly cost of replacement parts for 101 steam turbines averages only 1.6% of the initial investment, you are saving money . . . and plenty of it.

This amazing record was established by Terry turbines at a large refinery on the Atlantic coast. The percentage figure was determined by means of an accurate tabulation of the cost of replacement parts required over a two-year period.

These 101 Terry machines provide a good cross section of the various types of small and medium-size turbines made by the company. Ranging in size from 10 to 1200 horsepower,

they include single and multistage axial flow designs as well as the famous Terry solid-wheel turbine.

Such outstanding performance records are not at all unusual for Terry turbines. The thousands and thousands of these machines installed in refineries throughout the world provide an accurate yardstick for measuring turbine reliability.

Send for illustrated bulletins. No. S-116 describes the many advantages of the Terry solid-wheel turbine. For multi-stage turbines, ask for a copy of Bulletin S-146.



TERRY STEAM TURBINE CO.
TERRY SQUARE, HARTFORD 1, CONN.

TT-1194



# Do You Know About ALL of the REPUBLIC Line?

Check the Republic line of measurement and control equipment listed below. You'll find instruments and controls to meet your needs whether for a simple control or an automatic control system. And teamed with this equipment is an experienced engineering staff which can give you the right answer to your measurement and control problems.

ELECTRICAL FLOW METERS. For metering the flow of steam, water, gas, air, oil, brine, etc. The reading instru- ments, indicator, recorder and integrator, are remote read- ing and can be supplied singly or in any combination desired. Integration is continuous, an exclusive Republic feature.		Attential of flow, rate of flow free level speed of rotation, liquid level, etc. For proportioning two pressures of flows. Regulators may be either air or oil operated. Flexibility in design and construction allows the regulatof to perform any type of control action. Setting may b'
PNEUMATIC TRANSMITTERS. For converting process variables such as flow, liquid level, pressure, or liquid density into air pressures which vary proportionally with the process variables. These air pressures can be used as a measuring impulse for the actuation of an automatic controller or a direct reading recorder.	· 🗆	remote or manual.  AUXILIARY RELAYS. Multiplying, dividing, adding subtracting, maximum and minimum setting, ratio, ratio computing, sequential, splitter, squaring, square root extracting, and position indicating.
CO <sub>2</sub> METERS. Provide a continuous record of percent CO <sub>2</sub> in flue gas measured by the Orsat method. Furnished with either mechanical or electrically actuated remote reading indicator and recorder.		COMBUSTION CONTROLS. A centralized, automatic system for controlling steam pressure, combustion, furnace pressure, excess pressure, boiler level, etc. Automatically regulates the fuel and air input to a boiler in measured proportions and in a fixed ratio for the entire
<b>DRAFT INSTRUMENTS.</b> Indicating or recording types in single or multiple units. Furnished in all standard ranges of draft and pressure.		load range. Adaptable to multi-fuel firing.  DESUPERHEATERS. Atomizing type desuperheater uses a small quantity of high pressure steam to vaporize an automatically controlled amount of water in reducing steam
THERMOMETERS. A long distance, gas filled thermometer with either single or multiple pen recorder.		temperature to the desired degree.
LIQUID LEVEL INSTRUMENTS. Remote reading indicators and recorders. Also provided with various types of alarm devices.		VALVES — REGULATING AND PRESSURE REDUCING. Designed and built for all practicable ranges of pressures with either flanged or welded ends. Special body design sharply reduces erosion and noise. Cylinder operated
MULTI-POINT INDICATORS. Will indicate, on separate vertical scales from two to sixteen units of draft, pressure, flow, temperature, $\mathrm{CO}_{\scriptscriptstyle 20}$ , etc., in any combination desired.		valves available in sizes from 3 in. to 24 in. Hand operated valves in sizes from 1 in. to 8 in. Lever operated valves in sizes up to 16 in. Republic valves are built in accordance with A.S.A. Standards for all pressures up to
MULTIPLE RECORDERS. Strip Chart Type will record from three to six separate records of flow, temperature, $CO_{\nu}$ , pressure, etc., in any combination desired. Round Chart Type can have up to 4 pens.		2500 psi. Diaphragm operated valves are available to pressures from 125 to 1500 psi and from 3 in. to 10 in. is size. Special purpose alloy steel butterfly valves in size 4 in. to 24 in. are also available.

Data Books are available on any of the above equipment

### REPUBLIC FLOW METERS CO.

2240 Diversey Parkway • Chicago 47, Illinois

BRANCH OFFICES: Atlanta \* Albuquerque \* Boston \* Buffalo \* Cincinnati \* Cleveland \* Dallas \* Denver \* Detroit \* Houston Indianapolis \* Kansas City, Mo. \* Los Angeles \* Minneapolis \* New Orleans \* New York City \* Philadelphia . Phoenix \* Pittsburgh Richmond \* St. Louis \* Salt Lake City \* San Francisco \* Seattle \* Syrouse \* Shreveport \* Tules \* Vancouver, B. C.



# QUARTER-MILE ROADBED...sun-baked, ice-swept...YET STILL ON THE MOVE AFTER 14 YEARS OF COAL HAULING SERVICE!!!

Photographs may not lie; but, here's one that falls far short of telling the whole truth about the remarkable performance records chalked up by this Republic Rubber's Coal Handling Conveyor Belt.

But, then it's quite a story! You can see for yourself there's lots of sky overhead and that means sun ... constant, unrelenting sun beating down on the conveyor belt surfaces, until seasonal changes bring about onslaughts of rain, snow and sleet.

The load, of course, is coal... an abrasive, mine run coal that's dropped through chutes and carried by the belt to stockpiles located throughout the dock area.

With these facts in mind and knowing that when the ship moves

out, there's nothing to protect the belt against spraying lake water, consider this:

The belt is now fourteen years old and still going strong!!!

Purposefully, we've left the photo unretouched to show you just what a 14-year old Republic Rubber Conveyor Belt really looks like . . . to show you just how well a Republic Conveyor Belt stands against the ravages of time, hard labor and all the elements can throw at it. Incidentally, the dark spots you see on the belt's surface aren't worn places at all. That's water . . . water that makes ordinary conveyor belts mildew and prematurely fail, but holds few terrors for Republic Conveyor Belting because they're "mildew-

It's to your advantage to learn why Republic Conveyor Belts like this can year in, year out, many times outperform and outlast other brands of belting.

Despite abrasion, impact, flexing, weathering or contact with heat, oil and chemicals, Republic Conveyor Belts continue to be your best insurance against breakdowns, short life and high handling costs.

Write us today for the name of your local Republic Rubber Distributor who can offer expert advice and fast service on all industrial Rubber Products.

Remember, whether it's hose, belting, packing or any one of hundreds of different molded and extruded specialties . . . if it's built of rubber, Republic builds it better!

# REPUBLIC RUBBER DIVISION

LEE RUBBER & TIRE CORPORATION, YOUNGSTOWN 1, OHIO

INDUSTRIAL RUBBER PRODUCTS



Ever see a bronco at the first touch of the saddle? Ever see a gusher well come in? The resemblance doesn't end with the furious first burst of action, even though the saddled pony stands quiet... and the stream of black gold pours placidly into the refinery—until man renews his taming process.

Breaking a fractious horse... cracking petroleum... makes them both useful. And both tasks throw the full test of pressure on the men who tackle the job... and on the equipment they use.

Tanks and towers... in fact all refinery and chemical equipment built at Sun Ship has been meeting the toughest tests of pressure through years of service. That's to be expected. The men of Sun Ship who build it have shown their ability to meet and master the production pressure of time... and the engineering and shipping problems that go with the task of constructing and delivering the gigantic equipment that helps build a greater and stronger America.

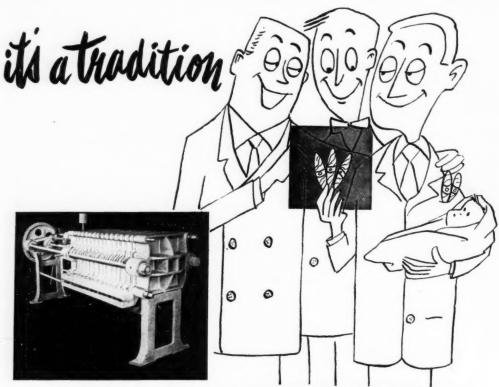


SHIPBUILDING

DRY

DOCK COMPANY

ON THE DELAWARE . CHESTER, PA.
25 BROADWAY . NEW YORK CITY



# AND QUALITY IS A TRADIT THE SPERRY FILTER PRESS!

Sperry has pioneered and developed the Filter press that today ranks as America's most widely used filter. This definite acceptance of Sperry engineering reflects the tradition of quality that for over a half century has set the standard for all Sperry equipment . . . as exemplified in these advantages of the Sperry Filter Press:

Greater Flexibility: Handles any kind of filterable mixture . . . requires less floor space . . . operates on low, medium or high pressure . . . can handle hot liquids without vaporizing . . . Uses filter paper or pulp, wire, wool, asbestos, glass, vinyon and other kinds of simple filter cloths.

Greater Performance: Produces maximum clarity . . . makes the driest cakes . . . can separate emulsions . . . delivers filtrate to higher level than filter . . . leak proof construction . . . can deliver cake in slab form . . . thoroughly washes the cake.

Greater Economy: Low first cost . . . low upkeep ... low installation cost ... low depreciation ... long life.

For specific data regarding your own filtration problem, consult Sperry. Send samples of your material for test run.



#### SPERRY FILTER BASES

All types . . . all sizes. Plain or punched to your specifications. Besides cotton and paper, bases are furnished in wool, synthetics, glass and woven metals.

#### D. R. SPERRY & COMPANY BATAVIA, ILLINOIS

Filtration Engineers for over 60 years

Eastern Sales Representative: H. E. Jacoby, M.E. 205 E. 42nd St., New York 17, N. Y.; Phone MUrray Hill 4-3581

Western Sales Representative: B. M. Pilhashy 833 Merchants Exchange Bidg., San Francisco 4, Calif. Phone DO 2-0375



#### SUPER CENTRIFUGE

(General Purpose Clarifier)

Highest centrifugal force commercially available (13,200 x g) makes this centrifuge extremely efficient for the clarification of liquids containing solids. Quick easy removal of solids from the tubular bowl, makes this unit ideal for clarification.





#### **DD-2 CENTRIFUGE**

(High Capacity Clarifier)

Disc bowl design provides stratification of liquids at a centrifugal force of 9500 x g to effect efficient clarification. Solids remain in bowl, so generally the DD-2 is used where a relatively low percentage of solids exists in a large amount of liquid.





#### **DH-2 NOZLJECTOR**

(Continuous solids discharge clarifier)

The solids discharge continuously from a series of nozzles located around the periphery of the disc bowl. The clarified product is discharged separately from the solids with a relatively small amount of the liquid. The DH-2 is indicated where the dryness of the solids is relatively unimportant. This clarifier is often used as a valuable solids concentrator.





#### **DG-2 AUTOJECTOR**

(Automatic continuous solids discharge clarifier)

A series of valves located around the periphery of the bowl are caused to open and close intermittently by the accumulation of solids in the bowl. The relatively dry solids discharge automatically from the valves; the clarified liquid discharges separately.



#### DV-2 CLARIFIER

(Externally controlled continuous solids discharge)



A series of valves located around the periphery of the bowl are caused to open or
close by an externally controlled hydraulic
system. Since both duration and frequency
of valve opening can be controlled closely,
it is possible to discharge solids with a high
degree of concentration. The DV-2 handles
a wide range of slurries with high percentage of solids, and solids ranging from
firm to slimy.



# a clarifying problem?

FIVE

SHARPLES ANSWERS

Sharples offers
your choice of the
ONE BEST CLARIFIER
FOR YOUR PURPOSE

If your process involves clarification of liquids, it will pay you to get in touch with Sharples. Peak clarifying efficiency results from the choice of the one best clarifier for your particular need.

# SHARPLES

2300 WESTMORELAND STREET PHILADELPHIA 40, PENNA.

NEW YORK • PITTSBURGH • CLEVELAND • DETROIT • CHICAGO • NEW ORLEANS SEATTLE • LOS ANGELES • SAN FRANCISCO • HOUSTON





In the year 1931 Taylor Forge gave industry its first real line of seamless, butt-welding pipe fittings. We say it was the first real line because it was the first to include not only long and short radius ells, but also full branch and reducing tees, concentric and eccentric reducers, stub ends, caps and welding neck flanges.

This was a fully planned development. Many years before Taylor Forge had foreseen the future of the butt-welding fitting...had realized that pipe welding could not go beyond its then crude stage until pipe users were given all the fittings necessary to make up complete piping systems.

So Taylor Forge went to work on this and after long research and development came out with the full line that became the inspiration of modern pipe welding.

Naturally the organization that started ahead has kept ahead . . . in design, in quality, in breadth of line. That is why so many men who have followed the development of the WeldELL

line, refuse to consider any other kind of welding fittings.



For up-to-the-minute facts, see your Taylor Forge distributor

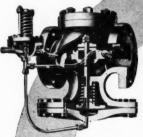
# TAYLOR FORGE

TAYLOR FORGE & PIPE WORKS, General Offices and Works: P.O. Box 485, Chicago 90, Ill.
Offices in all principal cities. Plants at: Carnegie, Pa.; Fontana, Calif.; Hamilton, Ont., Canada



Here are a few reasons why Spence Regulators give you accurate regulation and long, troublefree life:

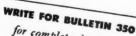
- Single-seat Packless Construction
- Large Balanced Metal Diaphragm
- Sensitive Pilots
- SECO Metal Seats and Discs
- Springs out of path of steam
- No dismantling for inspection



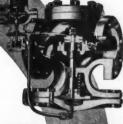
BACK PRESSURE CONTROL—Wide selection of sensitive pilots to meet exacting requirements. Initial pressure closing, guaranteed to shut tight. Packless construction, metal diaphrogens.



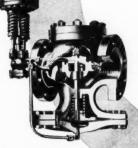
PRESSURE REDUCING—Self-operated, dead-end regulators powered by large, frictionless, metal diaphragms. Sizes 1/4 in. to 12 in. Pressures to 600 psi 750 F.



for complete details on Spence's line of automatic regulating valves



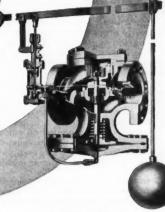
DIFFERENTIAL PRESSURE—Accurate control of delivery pressure at a constant, adjustable differential free 3 to 150 psi above another source of fluid pressure.



PUMP GOVERNOR—Constant or excess pressure control for steam pumps. Steam pressures to 600 psi 750 F, pump discharge pressures to 2000 psi.



TEMPERATURE REGULATING—Combined temperature and pressure control. No separate reducing valve required. Shuts tight, will not wiredraw or be damaged by overheating. Sizes to 12 in.



LEVER OPERATED—Pilot lever for connection by cable or mechanical linkage to floats or other devices. Slight actuertor motion opens and closes main valve.

SE-113

SPENCE ENGINEERING COMPANY, INC. WALDEN, NEW YORK





REPEAT orders are the surest indication of satisfactory service. In 1928 a well-known Tennessee cement company installed two Vulcan rotary kilns, each 10 feet x 215 feet, for manufacturing Portland cement by the wet process. During nearly a quarter-century of practically continuous operation these two kilns have given, and still give, such satisfactory service that another Vulcan kiln has recently been installed to provide 60% additional capacity.

The new Vulcan kiln, shown above, is much longer (10 feet x 300 feet), thereby permitting higher overall efficiency and greater capacity. Other improved features include a heavily reinforced all-welded steel shell mounted on our latest-type supporting roller and thrust bearings; all of which are automatically lubricated and easily adjusted to compensate for wear and moderate misalignment.

The main drive unit is fully enclosed and the gasoline-engine auxiliary-drive unit is as fully enclosed as possible; to promote cleanliness and safety. Both drives provide an ample margin of power over any probable requirement and are designed for many years of trouble-free service.

Every part of every Vulcan Kiln is designed and built with an extra margin of protection against mechanical troubles of every kind and that's why long-time users often order additional units from us without competition. They know that any necessary difference in first cost will be repaid many times over in greater freedom from breakdowns, shutdowns, and other operating expense.

# THIS BOOKLET TELLS WHY VULCAN KILMS ARE BETTER

and why they give more years of trouble-free service. Its 28 fullyillustrated pages are packed with specific information regarding the design and construction of Vulcan Rotary Klins. Coolers. Dryers and other related products. No charge or obligation. Write for Builetin No. A-442, giving name of your company.



# Vulcan Iron Works Established WILKES-BARRE, PA., U.S.A. New York City Office, 1849 O Church Street

Other Vulcan Products include Briquetting Machinery, Electric Hoists, Mining Machinery, Open Hearth Steel
Castings, Heavy Special Machinery and all types of Modern Industrial Locomotives Bulletins on request.

# BRIDGEPORT BRASS COMPANY

# COPPER ALLOY BULLETIN

"Bridgeport" MILLS IN BRIDGEPORT, CONN. AND INDIANAPOLIS, IND. — IN CANADA: NORANDA COPPER AND BRASS LIMITED, MONTREAL



Hundreds of combinations of different metals are possible in the manufacture of Duplex tubes.

# Duplex Tubing Handles Corrosive Products in the Petrochemical Field

The corrosion problem continues to become more complicated as new chemicals are added to the long and growing line of petroleum products. Tubing for conveying liquids and gases; for transferring heat; and for condensing gases must withstand the action of many types of cooling waters; sulfides, chlorides, ammonia, carbon dioxide, solvents, etc. Of the above, water for cooling purposes or when it is a contaminant of the product, is by far the greatest corrosion offender. Copper-base alloys are best suited to resist water corrosion.

Sea water is more corrosive than fresh water. Pollution from factory wastes and sewage complicates matters. Sometimes it makes corrosion worse—rarely is it beneficial. Which metal or combination of metals should be specified for tubing?

#### Duplex Tubing for Hydrogen Sulfide Corrosion

One of the most troublesome problems deals with corrosion of heat exchanger or condenser tubing which is attacked simultaneously inside and outside by two entirely different types of corrosive media.

A refinery tried steel tubing for cooling propane gas containing an appreciable amount of hydrogen sulfide and some ammonia added to neutralize acidic constituents. It was found necessary to retube the heat exchangers every one or two years due to tube failure on the river water side. When red brass was used, it failed from the gas side. Replacement of the straight steel or red brass tubes with Duplex tubes—low carbon steel to the gases and red brass to the water side—resulted in an average life ranging from 6 to 10 years.

A similar condition involving longer chain hydrocarbons, with a higher concentration of hydrogen sulfide and ammonia as an acid neutralizer, was improved by the use of the same combination of metals in the Duplex Tubing. In different stages where gases entered at temperatures of 200° F. to

120° F., Duplex made up of a low carbon steel tube lined with red brass was found very satisfactory.

In another application, gas from a caustic liquor that had been used to strip hydrogen sulfide and other materials from a stream of hydrocarbon gases, has been successfully handled by the same combination—steel to the hydrogen sulfide and red brass to the cooling waters. Amines used for gas stripping have also been satisfactorily handled with steel/copper duplex tubes.

# Lube Oil Coolers

Duplex tubes of aluminum to the oil side and copper to the cooling water side are finding increased application in oil coolers used either in manufacturing lubricating oils or in water cooling of lubricating oils from turbines, motors, etc.

In some services, stainless steel tubes have failed from trans-crystalline stress corrosion cracking, with certain types of cooling waters. Where stress corrosion cracking of stainless steel has occurred stainless steel tubes clad or lined with copper alloy have been successfully used. Stainless steel clad copper tubes are also being used to withstand corrosion and erosion by impinging high velocity vapors.

Inter and after coolers handling various compressed gases, often present a dual corrosion problem that cannot readily be handled by a single-wall tube. Impinging gases may lead to severe thinning at the entrance ends of the tubes which gradually diminish over a distance of about 12 to 18 inches. The 0.083" wall copper tubes originally used lasted less than two years. Replacement with Duplex — 0.055" copper over 0.035" aluminum greatly increased the life of the tubes in this service. After two years exposure, there was scarcely any corrosion detected.

More information on Duplex tube applications and methods of installation are found in Bridgeport's "Duplex Tubing Technical Bulletin No. 1950". Write for your copy on company stationery. (8753)

(Advertisement)

# Take the Guesswork out of Gauging



Fig. No.

### AUTOMATIC TANK GAUGE

FOR ALL TYPES OF LOW PRESSURE TANKS

Easiest to Install. Read. Operate. Maintain.

No oil tank should be considered properly equipped without a dependable, gas-tight automatic Tank Guage! The new "VAREG" Figure No. 2500 Automatic Tank Guage can eliminate the many errors of hand guaging and will, in addition permit a host of time and money saving advantages.

addition permit a nost of the advantages.

The Fig. No. 2500 is also adapted for installation of "VAREC" Electronic Remote Reading Gauging equipment and Electronic Hi-Lo Limit or Controller Switches. Write today for full information or send coupon below!



THE VAPOR RECOVERY SYSTEMS COMPANY

2820 N. Alameda Street, P. O. Box 231 Compton, California, U.S.A.

MAIL COUPON NO	W FOR NEW BULLETIN CP-3500			
THE VAPOR RECOVERY SYSTEMS CO. 2820 N. Alameda Street, P.O. Box 231 Compton, California, U.S.A.				
Company & Dep	Company & Dept.			
Nome	Title			
Street and No	Street and No.			
City and State_	City and State			
	25-3			

# new Type Eppenbach COLLOID

Featuring

Large Tangential Outlet which prevents back pressure and allows increased output capacity Both Rotor & Stator are Interchangeable Stellite rings and stones—facilitating replacement when required.

Sanitary fittings throughout.
Illustration shows large production Mill Model
QV-11 with 15 H.P. motor

Eppenbach Colloid Mills operate at speeds approaching the theoretical minimum required for true wet micro grinding—shaft speeds up to 10,000 R.P.M., speed controlled from rest to maximum velocity.

These Mills assure uniform grind through advanced engineering features including (1) Improved ball bearings which center the shaft and minimize lateral whip and (2) Invar shafting with zero coefficient of heat expansion.

All Mills can be made with pressure feeds and jacketed hoppers.

Consult our Sales Department with your technical

problems.
Write for literature describing Eppenbach equipment
—now manufactured and sold by:



Direct-drive model shown operates at 3500 RPM. Higher speeds can be furnished. Colloid Mills made in all sizes from 1/4 H.P. model laboratory size to 50 H.P. model.

# ADMIRAL TOOL & DIE CO., INC.

45-10 VERNON BOULEVARD

N. Y.



A copy of this quick-reading, 8-page booklet is yours for the asking. It contains many facts on the benefits derived from your business paper and tips on how to read more profitably. Write for the "WHY and HOW booklet."

McGraw-Hill Publishing Company, Room 2710, 330 West 42nd St., New York 36, N. Y.



# WHERE TO BUY

Featuring additional Equipment Materials, Supplies and Service for the Process Industries



### MAGNA MANUFACTURING CO...NC Plant: - HASKELL, NEW JERSEY

#### YATES COMPANY EXTRUDED PLASTIC PRODUCTS

Precision Extruders of Rods, Tubes, Strips, Special Shapes for builders hardware, chemical industries, electronics, furniture, toys.

Send inquirics for engineering recommendations.

YATES COMPANY
2211 Cemetery Road Erie, Pa



# W. P. HEINEKEN, Inc.

**Engineers & Manufacturers** 

DRYERS

KILNS..

For all purposes

50 BROAD ST. New York, N. Y.



MERRICK SCALE MFG. CO.

CHEMSTEEL CONSTRUCTION COMPANY, INC. 501 Chemsteel Bidg., Walnut St., Pittsburgh 32, Pa.

Send data on Engineering & Construction facilities for ACID-ALKALI-PROOF CONSTRUCTION of processing & storage tanks & flooring.

COMPANY....

ADDRESS.....ZONE....STATE...

# PROFESSIONAL SERVICES

PATENTS REPORTS

TESTING

PLANT DESIGNS INVESTIGATIONS GENERAL CONSULTING

RESEARCH MANAGEMENT **TRANSLATIONS** 

CHEMICAL AND BACTERIOLOGICAL ANALYSIS

#### R. S. ARIES & ASSOCIATES

Chemical Engineers & Economists COMMERCIAL CHEMICAL DEVELOPMENT
Process Analysis • Market Research
Survey-Technical and Economic
Design & Initial Operation of Complete Plants
Liousiage of New Product Development
400 Madison Are. EL-5-180 New York 17, N. Y.

#### W. L. BADGER

CONSULTING CHEMICAL ENGINEER

Evaporation, crystallization, and Heat Transfer; Complete plants for salt and caustic soda; Complete Dowtherm installations.

300 South State Street

 $T^{ODAY}$  more than ever before you must be sure before you proceed. The laboratories represented in this section offer you their facilities to help solve your analytical and testing problems-to belp you get greater efficiency with lower costs and above all to help you to be sure.

#### PROCESSES RESEARCH, INC.

Chemical & Mechanical

Process Design, Development, Economics, Special Process Equipment and Machine Design, Site Searches. Plant Layouts, Investigations.

2865 Vernon Place

Cincinnatt 19, Ohio

#### **GUSTAVE T. REICH**

Consulting Chemical Engineer DEVELOPMENTS — OPERATION CARBOHYDRATES INDUSTRY BY-PRODUCTS CABBON-DIOXIDE — WASTE DISPOSAL

Packard Building

Philadelphia Pa.

#### J. PAUL BISHOP AND ASSOCIATES

Consulting

Specializing in: Chemical Designing, Estimating and Engineering of New and Modernising of Old Food and Chemical Plants and Processes.

Internationally Known Write P.O. Box 348

#### KNOWLES ASSOCIATES

Chemical—Metallurgical—Mechanical Engineers

Consultation — Design Complete Plants — Equipment Heavy Chemicals — Ore Dressing 19 Rector Street New York 6, New York Bowling Green 9-3456

#### SANDERSON & PORTER

Engineers and Constructors

New York . Chicago . San Francisco

#### CARL DEMRICK

Technical Translations

Send for Circular

58 So. Broadway

Yonkers, N. Y.

#### KOHN & PECHENICK

Consulting Chemical Engineers

DESIGN

Reports Trouble-Sheoting Appraisals

262 Huron St. Brooklyn 22, N. Y.

#### Engineers

J. E. SIRRINE COMPANY

Plant Design & Surveys covering Chemical, Elec-trochemical and Metallurgical Production; Trade Waste Disposal; Water Supply & Treatment; Analyses & Reports.

### RICHARD F. ENNIS, JR.

Consulting Chemical Engineer Engineering and Economic Studies Design-Development-Research

Lincoln-Liberty Bldg.

Philadelphia 7, Pa.

#### THE KULJIAN CORPORATION

Consultants . Engineers . Constructors

Chemical . Industrial . Process

1200 N. Broad St. Phils. 21, Pa.

#### MARCUS SITTENFIELD

Consulting Chemical Engineer Piants - DESIGN - Equipment Economic - SURVEYS - Technical Process - DEVELOPMENT - Produc

Registered Professional Engineer Inut St. Philadelphia 2, Pa.

#### **EVANS** RESEARCH AND DEVELOPMENT CORPORATION

Organic and Inorganic Chemistry
Processes—Products

250 East 43rd St

New York 17, N. Y.

#### MARCO COMPANY, INC.

Researchers-Machine Designers-Consultants

Specializing in the development of continuous processing methods and special equipment for chemicals, food and other products.

Third and Church Streets, Wilmington 40, Delaware

FOSTER D. SNELL, INC.

Research Chemists and Engineers

A start of 75 including chemists, engineers, bacteriologists and a pilot plant are available for the solution of your chemical and engineering problems.

Welfa today for Engineering

problems.

Write today for Booklet No. 3

"The Chemical Consultant and Your Business"
29 West 15th St. New York 11, N. 3

#### FRASER-BRACE ENGINEERING CO., INC.

Designa Engineers & Constructors

Of
Hydro-electric Developments
Metallurgical, Explosives, & Industrial Plants
Chemical & Process Industries
Raifroads—Tunnels—Port Facilities
10 East 40th St., New York 16, N. Y. Lew 2-5570

# C. L. MANTELL

Consulting Chemical Engineer Process Research and Engineering

45? Washington Street New York 13, N. Y.

#### NICOLAY TITLESTAD CORPORATION

Chemical Engineer

Design — Consultation — Complete Plants sulphuric acid — phosphoric acid nitric acid oxidation of ammonia nitrogen products — acid concentration surplus dioxide — carbon bisulphide PE-6-0010

11 W. 42nd Street, N. Y. 18

#### GEORGE H. KENDALL

Consulting Mechanical Engineer
Cost Reduction Studies: Process or Product.
Redesign Existing Products for Greater Profit.
Trouble Shooting Production, Design, Cost Problems.
Specialists Automatic Machinery, Processes, Controls,
New Developments. Patent Studies, Investigations.
New Products & Process Engineering Studies
P. O. Box 3 (8st. 1923) Tel. Darten 5-1594
Norton Heights

#### JAMES P. O'DONNELL Engineers

CHEMICAL AND PETROLEUM PROCESS
PLANTS Design-Procurement-Construction Supervision Start-Up

39 Broadway, New York 6

#### THE J. G. WHITE ENGINEERING CORPORATION

Design - Construction - Reports - Appraisals

80 Broad Street, New York 4

#### CHEMICAL ENGINEER with GOOD MECHANICAL BACKGROUND

Wanted by Process Equipment Manufacturer in Northwestern Pennsylvania. Should have 3 or 4 years chemical plant experience and be capable of handling general supervision of engineering and mechanical design of company's line of special equipment. Please submit record of education, experience, references and salary expected.

P-5298, Chemical Engineering 520 N. Michigan Ave., Chicago 11, Ill.

#### UNUSUAL OPPORTUNITY FOR PLASTICS CHEMIST

For research and product development. Should be experienced in polyvinyl chloride compounding. An excellent opportunity to progress with a well established and rapidly expanding California oreanization having a healthy balance of government contracts and commercial business to assure excellent future prospects.

Employees of this a ganization have knowledge of this advertisement.

Give full particulars in letter—age, experience, education, references, personal history, salaries received, salary ex-cetted, and comments on willingness to move to California. Reply:

BOX 2393 TERMINAL ANNEX LOS ANGELES 54, CALIFORNIA

#### CHEMICAL ENGINEER

Large Western New York synthetic organic chemical plant has attractive permanent position for Chemi-cal Engineer, preferably with 2 to 3 years' indus-trial experience, for plant engineering project work. Reply to

P-4404, Chemical Engineering W. 42 St., New York 36, N. Y.

REPLIES (Box No.): Address to office nearest you NEW YORK: 330 W. 42nd St. (36) CHICAGO: 520 N. Michigan Ave. (11) SAN FRANCISCO: 68 Post St. (4)

#### POSITIONS VACANT

ASSISTANT MILL Metallurgist for large Copper Company Chile, South America. College graduate with some experience, to work in Mill Metallurgical Laboratory. 3-year contract. Transportation both ways and salary white traveling paid by company. In reply give complete details. P-5185, Chemical Engineering.

DESIGNING DRAFTSMEN with experience in concrete or mill construction large Copper Company Chile. South America. 3-year con-tract. Transportation both ways and salary white traveling paid by company. In reply give complete details. P-5188, Chemical Engi-

FIRST CLASS Mill Metallurgist to work di-rectly under Assistant Superintendent and be in full charge all testing and research large copper concentrator Chile. South America. Operation milling plants using crushing, grind-ing and froth flotation, etc. 3-year contract. Transportation both ways and sairry while traveling paid by Company. In reply give com-plete devalls. P-5175, Chemical Engineering.

MECHANICAL ENGINEER to assist in super-vision maintenance of fieet of whitcomb Danel Electric Looms of fieet of whitcomb Danel Electric Looms large couper company Chile, South America. 3-year contract. Trans-portation both ways and salary white traveling paid by company. In reply give complete de-tails. P-17:9, Chemical Engineering.

YOUNG CIVIL Engineering Graduate with YOUNG CIVIL Engineering Graduate with some experience in maintenance of track and track equipment for Railroad Department large Copper Chile, South America. 3-year contract. Transportation both ways and salary while traveling paid by Company. In reply give com-plete details. P-5182, Chemical Engineering.

(Continued on the following page)

# EXECUTIVE VICE PRESIDENT CHEMICAL FIRM

Progressive, successful, and expanding manufacturers of petroleum derived chemicals located in one of the largest cities of the Midwest requires an experienced senior executive to assume the post of EXECUTIVE VICE PRESIDENT. Responsibilities of the post are second only to those of the President and call for outstanding capacities to supervise widespread operations, activities, and affairs of the Company. Similar previous experience with manufacturers in like or affiliated field essential. Eligible candidates presumably are now well employed. Age 38-45. Should hold chemical engineering degree or be college graduate with advanced major in chemistry. Write fully giving qualifications, record, references, salary requirements. Enclose small snapshot or photo. Personal conference assured all eligible candidates. Address replies to

P-5332, Chemical Engineering, 520 N. Michigan Ave., Chicago 11, Ill.

#### WANTED

- 1 Plant Manager
- 1 General Superintendent
- Chief Engineer Plant Chemist
- 1 Industrial Engineer

For integrated asphalt roofing mill, having power plant, felt mill, roofing mill, asphalt plant, and related units. Each opening offers excellent career opportunity in well established middle West combinated to the combination of the combina

P-5322, Chemical Engineering 520 N. Michigan Ave., Chicago 10, Ill.

#### **Assistant Director of Purchases** National Industrial Multi-Plant Company Experience in chemical-petroleum-pharmaceutical field preferable though not essential. Salary \$12, 000 and up depending upon qualifications and ex-perience of applicant. Administrative ability neces-sary for consideration, Submit full resume.

P5311 Chemical Engineering 330 W. 42 St., New York 36, N. Y.

# CHEMICAL ENGINEER

Large central New York heavy chemical manufacturer has attractive permanent position for chemical engineer, preferably with some industrial experience for process design in Pilot Plant work with some traveling to several plants. Reply in

P-5312, Chemical Engineering 330 W. 42 St., New York 36, N. Y.

#### CHEMICAL PROCESSING MACHINERY SALES REPRESENTATIVE

Wanted by long established machinery manufacturer of chemical processing machinery. Applicant must know chemical processing industry. Prefer representative with engineering background and field sales experience in chemical processing equipment. Consideration will be given only to such applicants who can furnish good references with respect to character and ability. Exceptional opportunity for eastern market with headquarters in New York City. Applicant must be willing to travel, as well as take care of local accounts. Send complete details of qualifications, experience and educational background. Our organization has been notified of this advertisement.

RW-5114, Chemical Engineering 330 West 42nd St., New York 36, N. Y.

#### ANALYST

At least 2 to 3 years experience preferred; chemistry, physics or metallurgy background; to conduct chemical and spectroscopic analysis and mineral assay. Start as assistant analyst for training to become chief analyst in about a year. This is a permanent position with 12 month appointment on the staff of the School. Salary commensurate with experience and training.

Apply to: Associate Director ENGINEERING & MINING EXPERIMENT STATION School of Mines & Technology RAPID CITY SOUTH DAKOTA

#### WANTED ASSISTANT CHEMIST

FOR SUGAR FACTORY NEAR LARGE CITY

Requirements: Approximately 30 years of age, chemistry or chemical engineering degree, seweral years beet sugar laberatory experience and possibly some knowledge of came sugar refining. Good permanent position for qualified man, starting as soon as possible, in application, which will be kept confidential, take personal data, education, seperience, reference, remonaration expected and attach photomers, remonaration expected and attach photomers, remonaration expected and attach photomers, remonaration expected.

P-4987, Chemical Engineering 330 W. 42 St., New York 36, N. Y.

# CHIEF ENGINEER

For mining and processing firm.
Responsible design and construction.
Proven advisory ability. Mining exp. helpful.
"Many Junior Positions"
Call, write or wire:—Gladys Hunting (Consultant) DRAKE PERSONNEL Chicago 2. III.

#### EMPLOYMENT SERVICES

(Continued from preceding page)

SALARIED PERSONNEL, \$3,000-125,000. This confidential service established 1927, is geared to needs of high grade men who seek a change of connection under conditions assuring, if employed, full protection to present position. Send name and address only for details. Personal consultation invited. Jira Thayer Jennings, Dept. B, 241 Orange St., New Haven, Conn.

#### POSITIONS WANTED

ADMINISTRATIVE - PRODUCTION Engineer available. Graduate—age 40—Thirteen years diversified engineering and supervision experi-ence in non-ferrous fields. Experience in maintenance, construction, management, personne relations, supervision, production and consult-ing. Four years as Plant Manager of Chemi-cally controlled processing unit. Desires relo-cation. PW-5218, Chemical Engineering.

CHEMICAL ENGINEER. 24. member of Tau Beta Pi. Grad. June 1951. Some Experience in metallurgical testing and research. Eager, potentialities untapped as yet. Would like opportunity to start in Chemical firm—either development, process design, pilot plant, equipment design, or research work. Southwest USA; preferably California where presently residing. PW-5133, Chemical Engineering.

#### SELLING OPPORTUNITY WANTED

SALES ENGINEERING organization with es-tabilished following in chemical, Pharmaceu-tical and allied industries, desirous to represent additional processing equipment manufacturer in New York, New Jersey, Delaware and Penn-sylvania. Commission only. RA-4930, Chemi-cal Engineering.

#### SALES REPRESENTATION

Newly organized mechanical equipment sales engineering office being opened in Houston, Texas. Intentions are to serve the Petroleum, Chemical and other industries in the Southwest Territory.

Our personnel have wide range of capabilities and a large friendly clientele prospective.

We would appreciate replies from manufacturers desiring initial or changed representation in this grea.

#### **AMESCO**

5035 Beekman Road Houston 21, Texas

TECHNICAL REPRESENTATION IN CANADA Chemical engineer now working with consultants and industry in eastern Canada desires to contact used in the handling and treatment of water, stamm or waster liguids which would be applicable to complete the stamm of the stamm of

CUSTOM REFINING FACILITIES Available

Drum Lots-Tank Cars

Wanted

All Types of Crude Mixtures
 By-Products, Residues, Wastes
 Contaminated Solvents

#### TRULAND CHEMICAL & ENGINEERING CO., INC.

UNionville 2-7360 Box 426, Union, N. J.

# CHEMICAL PLANT

We are now manufacturing over \$20,000,-000 in various lines and wish to expand by acquisition of assets or stock of one or more industrial companies. In our nego-tiations the sellers' problems and wishes will receive full consideration. Present personnel will normally be retained.

Address all replies

"Confidential" C. J. GALE, Sec. 233 Breadway, N Y. 7, N. Y. BA BA 7-1819

#### WANTED—SURPLUS

Dyes - Chemicals - Pigments Plasticizers - Solvents By-Products - Wastes - Equipment

CHEMICAL SERVICE CORP. 80-04 Beaver St. New York 5, N. Y.

#### WANTED

Vacuum Dryers, Heavy Duty Mixers, Reactors, Kettles, Columns, Rotary Filter, Pulverizers, Filter Presses, S/S and non-corrosive Tankage. Idle or Set Up Plant.

P. O. BOX 1351 Church St. Sta. New York 8, N. Y.

#### WANTED:

Steel Pressure Tank about 40" I.D. by 48" high. ASME 100° P.S.I. working pressure. For impregnation of Metal Castings. Must be full opening head. Boited down type. Give full information including price, manufacturer, condition. Also drawins.

GODFREY AND WING, INC.

WANTED!

We are building a small process plant in Virginia nd would like listings on the following equipment.

—Process vessel—ctainliess or monel—3-4,000 gail. good for 100 lb. pressure. Apitator and Jacket desired.

Dowthern unit—100-200,000 BTU

Dowthern unit—100-200,000 BTU

Dowthern unit—100-100 lb to 2,000 gails. cap.

St. or monel tanks 1,000 to 2,000 gals. cap.
NORTHERN OHIO ENGINEERING CO.
x 3303. Akron 7, 0.

#### CHEMICAL PLANT FOR SALE

Located in Scranton, Penna. area

Two acres-One half with buildings totalling 55,000 sq. ft.

Railroad Siding-Main Highway. Non-restricted.

Very Low Price.

PEREZ EPSTEIN

Phila. 22, Pa.



When you buy from the Largest and **Oldest Dealer** in Rebuilt **Processing** Machinery YOU ARE CERTAIN THAT YOU GET THE BEST **FOR YOUR** MONEY



# As for 35 years . . . BUY WITH CONFIDENCE

#### FILTERING EQUIPMENT

- 4-#12 Sweetland Filters for 36 leaves on
- 4" c.c. Shriver 42"x42", Iron Filter Presses, Plate & Frame, 18, 27, 36, 54 chambers,

#### DOUBLE DRUM DRYERS

- 42" x 120" Buflovak Atmospheric, \$/\$ Conveyors, \$/\$ Elevator, \$/\$
- hood. -5' x 12' Buflovak Atmospheric. -32" x 90" Buflovak Atmospheric. -32" x 72" Buflovak Atmospheric.

#### **EVAPORATORS**

- 1—Swenson Triple Effect, 1320 sq. ft. total, with copper tubes, steam pumps, condenser and piping.

  1—Swenson Single Effect, copper tubes, 440 sq. ft. condenser, pump, etc.

  1—Swenson stainless steel Quadruple Effect, 2600 sq. ft. total, with inter-connecting piping, pumps, etc.

  1—Octes all copper Calendria, quadruple effect, 5,000 sq. ft. total, with separator, copper jet condenser and piping.

  4—Mojonnier S/S Vac. Pans, 3, 4′, 5′, 6′.

#### VIBRATING SCREENS

- 1—Tyler Hummer 4'x10', 2 deck, with 2 birators.

  -Battery of two 3'x5' Tyler Hummer, Type 33, with Generator Set for both.

  -3'x6' Selectro, single deck.

  -3'x6' Selectro, double deck—rebuilt.

  -18'x5' Selectro—rouble deck—rebuilt.

  -10'x5' Selectro—rouble deck—rebuilt.

  -Duy 5',5 single deck, 40'x44''.

  -motior. Rolopy' Testing Screen AC

#### **ROTARY KILNS & DYERS**

- 3-Bonnot 6'x60' Rotary Kilns, each with 3'x50' Rotary Cooler.

  1-7'x120' Vulcan Iron Works; 1-8'x135'
- -J'x120' Vulcan Iron Works; 1-8'x135' Rotary Klins.

  -Direct Heat Rotary Dryers, class XA
  -Direct Heat Rotary Dryers, class XA
  4'x20', 4'6''x25' single shell; 2-5'x40'
  single shell, all Ruggles-Cole. Also 2'7''
  x10' Roto Louvre.

  -8'x50' Louisville Rotary Steam Tube.
  -4'x8' Flaker or Cooling Roll.
  -5'x3' Rotary Vacuum Dryer, jacketed shell; 1-2'7'x8', Jacketed, with dust collector and condenser.
  -5'6x24' Direct Heat Rotary Dryer or Kiln, welded shell.

#### PEBBLE MILLS

- All porcelain lined 5' x 4', 235 gal. 6' x 8', 800 gal., porcelain and
- burrstone lined.

  Abbe #4 porcelain lined, 125 gal.,

  45" x 42".

  Patterson 24 x 36" 25 gal.

#### CENTRIFUGALS

- 1—42" ALL STAINLESS STEEL, Centritugal, Amer. T & M Co. with 5/5 basket, curb, cosing, shaft unloader and 40 HP variable speed Slip Ring 3/60/440 V 1200 HPM motor with full controls. Suspended, bottom discharge type. Re-buill Ready to ship.
- 1—Tolhursi susp. Centrifugal with perf. 40" MONEL basket. Bottom discharge. 2 speed, 20 HP 5 HP, 3/60/440 V Motor, All contact parts Monel.

#### **PULVERIZERS**

- 3—#5047 Raymond High Side, 7½" face rolls, Whizzer Separators, New Oil Journals, complete.
- 2—Raymond 4-roll High Side Mills, each complete with 2-50 H.P. 3/80/2200 volt motors, connecting piping, etc.

  1—4'8 x 7' Ball Mil, Allis Chalmers, iron lined. Used 100 hours.
- 3-Mikro Pulverizers, 2TH, 2SI, 4TH.  $1-6'' \times 15''$  Sturtevant Jaw Crusher, to
- 1—24" x 15" Sturtevant Crushing Rolls, balanced type.

#### JACKETED KETTLES

- 2—500 gal. steel jacketed closed agitated Vacuum Reactors.
- 2—S/S 1700 gal Pressure Cooker, agitated, with reflux condenser.
   6—Dopp C.I. 80, 100, 150, 350, 600 gal.
- 7—Steel, agitated, 350, 500, 700, 800.
- 1—300 gal. stainless steel, 100#.
- 1-Dopp dbl. motion 100 gal. 700 gal. closed, with Simplex Turbo Mixers, reduction drive, m.d.
- 3-9500 gal., welded, agitated, open.
- 28-Aluminum, 50 to 500 gal., some agi-
- 19-Copper, 25 to 600 ggl.

#### **NEW STAINLESS STEEL FABRICATION**

We have available excellent facilities for fabricating Stainless Steel Tanks, Kettles, Condensers, Reactors, Auto-claves, Distillation Columns, Filter claves, Distillation Columns, Presses, Heat Exchangers, etc. ASME Code Construction

Will gladly furnish estimates to your specifications.

#### SPECIALLY PRICED FOR QUICK REMOVAL

- Devine #21 Vacuum Shelf Dryer, 13 shelves 59" x 78", Condenser and

- shelves 59" x 78", Condenser and Pump.
  6—Devine "28 Vacuum Sheif Dryers, each 20 shelves 59" x 78", surface condensers and vacuum pumps.
  2—condensers and vacuum pumps.
  2—the condensers and vacuum pumps.
  20', 46" x 18'6", 4' x 13', each stone-lined, scoop feed, pebble charge, cultch pulley.
  20', 4'6" x 18'6", 4' x 13', each stone-lined, scoop feed, pebble charge, cultch pulley.

#### DRY POWDER MIXERS

- 1—Kilby jacketed Horiz. Ribbon Mixer, 14' x 6'6' x 7', stuffing boxes, 450 cu. it. capacity.
- 1-Howes 3,000#, double ribbon, 10' x 3' x 42".
- 1—Day Size F, 1850#; 1—Howes 1800# dbl. ribbon; 1—Munson Rotary 1,000# batch.

#### MISCELLANEOUS

- 2—Buflovak 6' dia. Vacuum Crystallisers; 1—6' dia. Atmospheric, jacketed.
- 1—6' x 14' Hardinge Rotary Counter Cur-rent Classifier, also for dewatering or scrubbing.
- Dorr two-stage Classifiers, each with two rakes, total length 27', gear re-ducer and motor.
- Davenport #3A Dewaterer, with speed reducer and 5 HP AC motor.
- 1—Mechanical Cooker, 5' dia. x 16 long, jacketed, agitated. Insurance Certiti-
- 1-Capem S.I.F. Capper, with feeder.
- 1—Copper Rectifying Column, 6 sections, 30" dia. x 33' high, bubble cap type.
- 3-7' x 60' Rotary Kilns, equipped with roller bearings, gear reducers, motors.
- -6' x 60' Vulcan Rotary Kilns, each with 3' x 50' Rotary Coolers, firing hood, all bases, complete.

#### BAKER PERKINS MIXERS

4-3000 gallon, size 30, type X-BS, welded.

IDLE MACHINERY? WE BUY FOR CASH -SEND LIST-

# CONSOLIDATED PRODUCTS CO., INC. NEW YORK 38, N. Y.

2015 PARK ROW BLDG. BArclay 7-0600 · Cable Address: Equipment, N. Y.

OLDEST AND LARGEST DEALER IN REBUILT PROCESSING MACHINERY

# **Rebuilt For New Machine Accuracy** At Tremendous Price Reductions

International Stainless Steel Straightline Vacuum Filler, 160 per minute.

Resing S and LC Automatic Cappers.

Capem E4F 4-Head Rotary Capper.

Island Equipment Styline Automatic

CRCO New Way MH Wraparound Labeler. S. & S. G1, G2, G6 Auger Fillers.

Stokes and Smith Model HG88 Duplex Auger Powder Filler.

Colton 2 and 3RP Rotary Tablet Machines. Stokes 2C Cream Filler and Closer.

Triangle Package Elec-Tri-Pak G2C, G2S, A2C, N2CA and A6CA Fillers.

Filler 4 Head Stainless Steel Filler.

Horix S. S. 14-head Rotary Filler.

Standard Knapp No. 429 Carton Sealer.

Mikro 4TH, 3TH, 1SH Pulverizers; Jay Bee U1, Schutz O'Neill Mills.

Tri-Homo #5 Colloid Mill, 71/2 HP.

3500 gal. working cap. Steam Jacketed, Double Arm Mixing Tanks for mixing, storing or processing of your materials.

B. P. 150 gal. Unidor S. J. D. A. Mixer.

Stokes, Day, New Era, Hottman Mixers, from 2 to 450 gals., with and without Jackets, Single, Double Arm Agitators.

Baker Perkins and Readco Heavy Duty 5 to 150 gals. Double Arm Jacketed Mixers with Sigma or Fish Tail Blades.

Ross, Day, Pony Mixers, 8, 15 gal. caps.



### Act Now For Choice Buys Tell Us All Your Machinery Requirements

UNION STANDARD EQUIPMENT CO. 318-322 Lafayette Street New York 12, N. Y.

#### COMPRESSORS

I.R.-30-1000# 12 CFM Bury-200# 66 CFM I.R -- 50-3000# 110 CFM Worth-1500# 219 CFM Worth-600# 310 CFM Worth-Booster-250# Worth-Booster-300# I.R.—Booster—200#

28 to 2000 CFM 12# to 125# All Makes and Sizes in Stock

#### Tradition Counts Rebuilt by AMERICAN

#### VACUUM PUMPS

82

187 C.P. 10 x 6

193 Fuller Rotary

C.P. 12 x 6 I.R. 18 x 7 (2) stage

800 Worth 18 x 9

1184 Penn 22 x 9

C.P. 24 x 11

1987 Worth 26 x 13

AMERICAN AIR COMPRESSOR CORP. NORTH BERGEN NEW JERSEY

#### STEEL STORAGE TANKS

18-8000 & 10,000 Ggl. R.R. Tanks. -20,000 gal. New 5/16 Inch Horiz. -10,000 & 15,000 Gal. 1/2 Inch Horiz.

-2500, 5000 & 10,000 Bbl. Vert. L. M. STANHOPE, Rosemont, Penna DORR THICKENERS-24' x 10' & 12' x 8'

SCREENS-18 x 48 double Selectro w/ motor.
Tyler Hummer 3 x 5-single/double/triple.

HAMMER MILLS—Wms. LG 1—BX 825— Reg. #1 & GA30.

PULVERIZERS - Sturtevant #1 Ring -Bradley Hercules Jr. FORK LIFT - Towmotor - gas -4000#

TANKS-6 x 20 x ½ cone bottom 9000-12000-15000 gal. 5' x 40'-6' x 80'-8 x 80.

ROTARY KILNS 24' x 18' -- 4' x 30' 20-12 x 28-24 x 36.

CRUSHERS, JAW-8 x 11--11 x 14--11 x 20--12 x 28--24 x 36..

DUMP CARS - 7 yd.-36" ga w/loco FILTER PRESSES—Shriver 24" x 28 P&F—Closed—30 w/28 P&F open, washing—30" Shriver w/30 P&F—closed wash-

LAWLER COMPANY

Durham Avenue Metuchen, N. J. Metuchen 6-0245

#### For Sale

I—Eppenbach Stainless Steel Home Mixer, complete with a 7½ HP Explosion-Proof Motor.

Baker-Perkins 100 Gal. Stainless Steel Mixer, double-arm, sigma blades, with 20 hp explesion-proof motor.

—Perbole Mills 40 to 500 Gal.

—Perbole Mills 40 to 500 Gal.

HGGI SPEED Rotter Mills 5224 to 16"x40".

—Motor Drien Belt Conversationary of the Motors.

—2251 Mixer-Palverizers with 10 hp Motors.

SPECIALIZING IN REBUILT MACHINERY

#### Irving Barcan Company

249 ORIENT AVE. JERSEY CITY 5, N. J Phone-DElaware 2-6695-6

#### YOUR PREFERRED SOURCE FOR GOOD REBUILT EQUIPMENT

2 Budowac Vac. Shelf Dyers—20 thelves 38" x 42" a 5 shelves 38" x 44" complete units with condenser, vac. pump & motor 40" a 5 shelves 38" x 44" complete units with condenser, vac. pump & motor 40" a 5 shelves 38" x 44" a 6 shelves 11 shelves

WHAT HAVE YOU FOR SALE? for BETTER BUYS & SERVICE Phone SOuth 8-4451-9264-8782

You can BANK on

#### EQUIPMENT CLEARING HOUSE, INC. 280-10th ST . PKLYS 15 9 Y

1-42" x 16" Allis-Chalmes crushing rolls.
1-36" x 16" Sturtevant crushing rolls.
2-24" x 14" Rogers crushing rolls.
1-4" Raymond Whitzer coparator.
5" x 50" 7½ x 60", 7" x 60", 6" x 60", 4" x 30" and 3" x 16" dryer. FOR SALE

W. P. HEINEKEN, INC. 50 Broad St. Tel. Whi. 4-4236 New York 4, N. Y.

# Cast Your Eyes Over These BRILL Buys!

OUR QUARTER CENTURY OF DISTINGUISHED SERVICE TO INDUSTRY ADDS UP TO GUARANTEED SATISFACTION!

#### DRYERS-KILNS

- -Vulcan 8' x 135', 58" shell, 2-14" tires,
- 1-Vulcan 8' x 115' 58" shell, 2-14" tires, complete.
- -Vulcan 7' x 160', 7' x 110', 58" shell, 2-12" tires, complete.
- -Allis-Chalmers 10' x 90', 9/16 shell,
- 2-14" tires, complete. 1-6' x 60', 34" shell, 2-8" tires, complete. 1-Vulcan 4'2' x 50', 38" shell, 2-6" tires,
- complete. -Link Belt 2'7" x 8' monel, 2'7" x 10' steel, Roto-Louvre Dryers.
- Rotary Dryers 7' x 70', 7' x 60', 5' x 67', 4'6" x 40', 4' x 25'.

  -Louisville Rotary Steam Tube Dryers 6' x 50', 6' x 30', 3' x 20'.
- -Couisville Rotary Steam Tube Dryer 6' x 27', S.S. tubes. -Devine 17 shelf double door vacuum Dryers 59" x 78".
- Devine 6 shelf Vacuum Dryer 40" x 43". -Stokes & Buflovak Rotary Vacuum Dryers
- 30" x 8', 3' x 15', 6'6" x 38' Blaw-Knox Stainless Steel Rotary Vac. Dryer 42" x 8'.
- -Buflovak 60" x 144", 42" x 120", 32"
- -Buflovak 42" x 120", 32" x 90" Atmos-pheric Double Drum. Single Drum 60" x 80" Flaker.
- 1-14 Truck steam heated Dryer 1680 sq.

#### FILTERS.

- -Vallez Pressure Filters 360 and 540 sq.
- 1—Sweetland #12 with 36 leaves.
  1—Sweetland #10 with 36 steel leaves.
- Sweetland #7 with 27 steel leaves.
- -Oliver Rotary Vacuum 11'6" x 14', 8' x 12', 8' x 10', 8' x 8', 5'3" x 6', 3' x 1'. -Eimco Rotary Vac. 8' x 8', 4' x 5', 4' x
- Oliver 8' x 8' Rotary Precoat Filter, rubber-lined.
- -Feinc Rotary Vacuum 8' x 12' steel with drive, etc. Shriver 36" P&F, 30 chambers, c.i.,
- closed delivery.
- -Sperry 36" Recessed, 48 chambers, c.i.,
- open delivery. -Shriver 30" P&F, 30 chambers, c.i.,
- open delivery.

  -Sperry 24" P&F, 16 chambers, c.i., closed delivery.
- Shriver 24" Recessed, 30 chambers, c.i., open deliver
- Shriver 18" Recessed, 30 chambers, c.i., open delivery. 2—Sperry Aluminum 30" and 24" P&F, 22 and 26 chambers.
- -Shriver, Sperry Filter Press Skeletons 42" to 18".

#### CENTRIFUGALS

- 1-Tolhurst 48" Center Slung S.S., perforated basket
- -Tolhurst 40" Center Slung rubbercovered, perforated basket.
  -Fletcher 40" Center Slung S.S., perfor-
- ated basket.
- -Tolhurst 32" Suspended Monel, bottom discharge, perforated. -Tolhurst 26" suspended Monel, bottom
- discharge, perforated. -AT&M 42" Suspended S.S., bottom dis-
- charge, perforated.

  -AT&M 40" Bronze Baskets, bottom discharge, perforated.
  -Fletcher 40" Suspended, Bottom Dis-
- charge, S.S., perforated basket. -Sharples C27, C20, 316 S.S. Super-D-
- Hydrators. -Bird 36" x 50" solid bowl, stainless. -Bird 36" x 50" solid bowl, rubber and

#### FOR YOUR SPECIAL CONSIDERATION

- 1—Ruggles Cole Class XH14 par-ellel flow Dryer 90" x 60" NEW.
- Oliver monel 8' x 10' Rotary Vac. Filters.
- Rogers Spray Dryer 16' dia. with all accessories. Pfaudler 100 gal. Glass-lined
- Stills with condensers. Steel 2000 gal. jacketed, agi-
- tated, 200 psi Reactors.
- -Pfaudler 350 gal. glass-lined, jktd. agitated Reactor. Dopp 250, 150 gal. jacketed,
- agitated kettles. Rotex #42 Double Deck Screens
- 40" x 84". Buflovak VRC, S.S. Single Effect
- Evaporator 94 sq. ft. Swenson Quadruple Effect Evaporator S.S. 2600 sq.ft
- 1-Buflovak 6' dia. Vacuum Crystallizer.
- -Hardinge 4½' x 16" conical steel-lined Ball Mill 30HP motor.
- -Vertical Storage Tank 30' dia. 26' high, 135,000 gal.
- -Tubular Condensers, Type 316 S.S., 370 sq.ft. each.
- -Bird 18" x 28" steel solid bowl Centrifugals.

#### **PULVERIZERS**

- 3-Raymond 5 roll, 4 roll High Side Mills
- 1-Bauer 36" Attrition Mill 2-50HP motors.
- -Patterson, Abbe Pebble & Ball Mills
- 60 to 1000 gals. 2—Premier Colloid Mills 8" dia., S.S. 1—Eppenbach QV7 Colloid Mill.
- Jeffrey 36" x 24", 20" x 12" Hammer Mills.
- Raymond, Gayco Mechanical Separators 14', 12', 4', 3'. -2 Roll Rubber Mill 6" x 12".
- 2-Mikro No. 1SI, No. 1SH Pulverizers. 1-Fitzpartick Comminuting Mill 5 Hp.

#### SCREENS

- -Selectro S.S. double deck 4' x 10'. -Sprout Waldron S.S. single deck, 40" x
- -Robinson Single Deck 40" x 104" Tyler Hummer 3' x 15, 3' x 10', 4' x 7'
- Single Deck. 5—Tyler Hummer 3' x 5' Triple Deck.

  1—Abbe #2 Blutergess Sifter.

#### MIXERS-ALL TYPES

- 7-Baker Perkins 200, 100, 20, 9 and 1/2 hal., blades. jacketed, double arm, sigma
- Baker Perkins 300 gal. Unidor S.S.
- -Baker Perkins ½ gal., jacketed. -Baker Perkins, type JNM, 100 gal., jacketed, double arm.
- Day 30 gal. Imperial jacketed, double
- Rodgers 200# to 3000# Powder
- Mixers. -Electric, Portable Agitators 1/4 HP to 5
- HP. NEW
  - 4-Day, Ross, 8 and 50 gal. Pony Mixers.

#### MISCELLANEOUS

- 20-Bucket Elevators, steel housings, 34' to 90' centers, 8" x 5" to 24' buckets.
- Stokes Vacuum Pumps 15 to 100 CFM.
- -Milton Roy Proportioneer Pump, S.S. and Hastelloy, 10 GPM. -Devine, Buflovak, Condensers and Re-
- ceivers, 20 to 90 sq. ft. -Groen 150, 125 gal., S.S., jacketed, agitated, kettles.
- Stokes DD2, D4 Rotary Tablet Ma-
- -38" dia. Stainless Steel Revolving Pans.
- -Nash AL671 Vacuum Pumps 20 cfm.
  -Olivite, Duriron, Rubber, Durimet and Haveg Centrifugal Pumps 11/2"



BRILL FOUIPMENT COMPANY 2401 THIRD AVENUE . NEW YORK 51, N. Y

Telephone: CYpress 2-5703 · Cable: Bristen, N. Y



### FOR IMMEDIATE SHIPMENT PHONE - HANOVER 2-4890

#### CENTRIFUGES

40" perforated, steel, Tolhurst. 40" perforated, SS, Fletcher. 40"x60" Bird, rubber covered. 36"x50" Bird, rubber covered. 24" Bird, CH, SS, series 200.

#### COLUMNS-TOWERS

\*\*X5\*\*X5\*\* Absorption (2—UNUSED).

5\*\*47\*\*X5\*\* Absorption, ASME, 20 trays (2).

5\*\*48\*\*X5\*\* Absorption, ASME, 14 trays.

3\*6\*\*X5\*\*X5\*\* Absorption, ASME, 14 trays.

3\*6\*\*X5\*\*X5\*\* Absorption, ASME, 14 trays.

24\*\*X13\*\* C.I. Fractionating, 18 Plate.

6\*\*X2\*\*X5\*\* Bubble Cap. 19 trays.

5\*\*X3\*\*X5\*\* Paubble Cap. 53, 21 trays.

5\*\*X3\*\*X5\*\* Paubble Cap. 53, 21 trays.

#### DRYERS

DATERS
Rotary, Vacuum, 3'x15', jacket'd., \$\$ clad.
Double drum, 32'x72''.
\$\$ fokes, Rotary, Vacuum, 30''x8', complete.
Blaw-Knox 5'x6' Almos. single drum.
Proctor & Schwartz, 24''x28''9'' Conveyor.
Proctor & Schwartz, 8'x94'' \$\$ Conveyor.
Proctor & Schwartz, 8'x94'' \$\$ Conveyor.

#### FILTERS

FILTENS
1/6"x18" Oliver, all steel.
8"x12" Feinc, all steel.
8"x10" Oliver, wood and steel (3).
8"x8" Oliver, lead covered.
4"x5" Oliver, steel.
3"x4" Oliver, steel.
3"x4" Oliver, steel.
3"x5", 55 chembers, center feed, open.
12" Sperry, aluminum chambers.

#### KETTLES-REACTORS

2000 gal. agit., jackt'd., 200 PSI (3). 1000 gal. 54"x7"x3'4", 300 PSI. 500 gal. Pfaudler, type LL. 400 gal. Pfaudler, jackt'd., agit.

#### KILNS-COOLERS-DRYERS

KILNS—COULERS—ON

''x125'x1/5"

10'x90'x9'16" Allis-Chaimers.

8'x80'x4/" Vulcan.

''x45'x1/5"

''x60'x4/" with lifters.

5'x6''x5/16" with lifters.

4'6'x40'x4/"

''x10'x1/16" with lifters.

4'4'x40'x4/10"

'x10'x1/16" with lifters.

4'6'x40'x4/10"

'x25' Allis-Chaimers, complete.

#### MILLS-PULVERIZERS-CRUSHERS

24"x24", single roll. 23"x12' double shaft, L. B. Pug. 5'6"x20' Smidth. Raymond #1 (2). Raymond, 4-roll. 6'x8' Abbe, style GPH (2). K-200 Kombinator, SS. Day, 3-roll, 16"x40". A2, Jeffrey, 24"x18".

Paddle, double shaft, 140 cu. ft. (NEW). Readco 11/2 SA, 88 gals. Ajax, #3 Super, 173 gals. Dayton, 100 gals., vert., steel, agit. 3900 gal. jackt'd., ASME (7). Champion, 110 gals. Johnson, paddle, 2190 cu. ft. (2).

600 gal. copper. 1500 gal., jacketed, cast iron.

#### TANKS & PRESSURE VESSELS

135,000 gal. 30'x26' with coils. 16,000 gal. 96"x45'x3/4" 150 PSI, ASME. 12,000 gal. 8'x32'x1/4" (NEW). 8,500 gal. vert. 8'x23'x5/16" (NEW). 8,200 gal. 70"x40'x2" 390 PSI (4). 6,000 gai. 8'x15'x3's" alu 4,100 gal. vert. 5'x28'x½" (NEW). 3,400 gal. 7'4"x10'x¾", type 430 SS. 1,250 gal. 4'x14', 106 PSI. 1,050 gal. 4'x12'x1/2", 106 PSI. 6,500 gal. TANK CAR TANKS.

#### TANKS-LEAD LINED

525 gal. 42"x7', agitated. 900 gal. 5'x6', agitated. 1200 gal. 5'x8'.

THIS IS ONLY A PARTIAL LISTING . SEND US YOUR INQUIRIES WRITE FOR OUR CATALOG



MACHINERY & EQUIPMENT MERCHANTS

# **EQUIPMENT** GITATORS Vacuum - Transfer - Circulating

#### PUMPS

Stainless Steel - Bronze - Iron - Rubber - Lead - Aluminum AIR COMPRESSORS • BLOWERS • STEAM PUMPS • EXP. PROOF MOTORS

#### SUPERIO EQUIPMENT CO. 138 GRAND ST., N.Y.C. CA-6-6983

#### WE BUY AND SELL

Equipment throughout North and Central America. See our advertisement August issue.

A. J. O'NEILL LANSDOWNE, PA.
Phila. Phones: MAdison 3-8300—3-8301

#### FOR SALE

3—32"x00" Buflovak Double Drum Dryers, 600 gal. 8.5. Tank, 54"x60".

600 gal. 8.5. Tank, 54"x60".

900 to 200 gal. 8.8. Mix Tanks, water jkt. 3000 gal. 8.5. Truck Tanks, Trailerized. 75 gal. Monel lit. Kettle, 5722". galt. 75 gal. 75 gal.

LESTER KEHOE MACHINERY CORP. New York 17, N. Y. I East 42nd Street.

MUrray Hill 2-4616

# **BEST BUYS** AT MEC

-Buflovak 6' Jack. Vac. Crystallizer -Aluminum Bubble Cap Columns 27'' and

3—Aluminum Bubble Cap Columns 27" and 38"
6—Bucket Elevators 8' to 40" overall
1—Devine 13 Sheli 44" x 43" Vac. Dryer
1—Stokes 6 Sheli 24" x 36" Vac. Dryer
1—Stokes Dryer Double Drum 48" x 126"
1—Buffalo Dryer Double Drum 42" x 126"
5—Filter Press 18" to 42" Wd Plate 6

Frame
2—Sperry 36" Filter Presses, Hyd. Closures
8—Stainless Steel Jack. Kettles with Ag.
100 to \$50 gals.
2—Cast Iron Jack. Kettles with Ag.
2—Cast Iron Jack. Kettles 250 6 800 gals.
2—Eppenbach S.S. AGI Mixers—150 gal.
kettles
1—Stainless Steel Jack. Mixer 75 gals.
1—Day D-8 Jack, Mixer—800¢ Cap.
1—W 6 P Mixer 100 gallon, Sigma Blades
M. D.
3—Mixro Pulvariance 6 200

-Mikro Pulverizers 2 TH and 2 FF-10 HP.

Gruendler W.B., Jr. Pulverizer, 10 HP., A.C. Motor

Robinson Size 1212, Rotary Cutter—10 HP, A.C. Motor Raymond 16" Screen Mill—5 HP, A.C. Motor

Motor

-Rotex Screens 40" x 60" and 40" x 120"
-Stokes 43-A Granulator—S.S. Parts
-Stokes Rotary DD-2 Tablet Machine
-Stokes "F" Single Punch Tablet Ma-

-Stainless Steel Tanks 100 to 5700 gais. 3—Horiz, Steel Tanks 3000 to 12000 gals. 6—Stokes 212C Vac. Pumps W.C. 100 C.F.M. 1—Day Jack. 30 gal. Giant Kneader 6

Send for your copy of Bulletin A-30, listing over 500 desirable items. We invite your inquiries and we pay top prices for individual items to complete

The MACHINERY & EQUIPMENT Corp. 533 West Broadway New York 12, N. GRamercy 5-6680

#### WE HAVE IN STOCK FOR IMMEDIATE DELIVERY THE FOLLOWING TYPES OF EQUIPMENT

Agitators Autoclaves Boilers Air & Refrigeration Compressors Colloid Mills Double Drum Dryers Dehumidifiers Evaporators

Filter Presses

Heat Exchangers Material Handling Stainless-Steel Jacketed Kettles

Mixers-Ribbon & Sigma Blades Motors Pulverizers Pumps Sifters Stainless-Steel Tanks Large & Small Steel Tanks

Three Roll Mills Consult Us For Your **Chemical Processing Equipment** SEND US YOUR INQUIRIES

WE BUY ONE ITEM OR ENTIRE PLANTS

# AARON Equipment Company

1347 So. Ashland Ave., Chicago S, Illinois PHONE: CHesapeake 3-5300

# DON'T BE HELD UP

# GET REAL VALUES AT REASONABLE PRICES-FROM

- 1—Sparkler Stainless Steel Filter, Model #18-5-12.
- Sparkler Monel Jacketed Filter, Model #33-8-26.
- Sparkler Steel Jacketed Filter, Model #33-D-7.
- 1-Sperry Aluminum 42" x 42" Plate & Frame Filter Press, 34 Chambers, Closed Delivery, 3" Frames "Unused". Shriver Aluminum 24" x 24" Plate & Frame Filter Presses, 35 Chambers, Closed Delivery, 1" Frames.
- 1—Shriver Stainless Steel 24" x 24" Filter Press, 10 Chambers, 4 Eye, Closed De-

- DRYERS—KILNS 1—Louisville Rotary Steam Tube Dryer,
- 6' x 50'.

  1-Rotary Kiln, 5' x 54'.

  1-Jabez Rotary Dryer, 40½'' x 11'8".

  1-Monel Rotary Dryer, 3' x 24'.

  1-Huhn Rotary Steam Tube Dryer, 3' x
- 2-Buflovak Vacuum Drum Dryers, 24" x
- 20".

  -Buflovak Stainless Steel Double Drum
  Dryer, 6" x 8".

  -Buflovak Stainless Steel Vacuum
  Double Drum Dryer, 6" x 8".

  -Buflovak Double Drum Dryers, 5' x 12'.

  -Buflovak Double Drum Dryer, 32" x
  80".
- 1—J. P. Devine Vacuum Dryer, 5' x 25'. 1—Carrier Engr. Truck Dryer, 3 Trucks.

- 1—1. P. Devine various Dryer, 3 Trucks.

  1—Carrier Engt. Truck Dryer, 3 Trucks.

  1.—Shriver 42" x 42" Evedur (Bronze)
  Plate & Frame Filter Press, 40 Chambers, Closed Delivery.

  1.—Sperry 42" x 42" Cast Iron Plate & Frame Filter Press, 18 Chambers, Closed Delivery.

  2.—Sperry 42" x 42" Cast Iron Plate & Chambers, Closed Delivery, Steam Incketed, 48 Chambers, Closed Delivery, 24 & 25 Chambers, Closed Delivery, 24 & 25 Chambers, Closed Delivery, 24 & 25 Chambers, Closed Delivery, 25 Chambers, Closed Delivery, 25 Chambers, Closed Delivery, 25 Chambers, 12" x 12" Cast Iron Plate & Frame Filter Presses, 12 and 20 Chambers.

  1.—Valler Filter #3-B.

  2.—Sweetland Filters, #2, 5, 7 and 12.

  2.—Oliver Rolary Steel Filter, 3" x 12" x 6.

- screens. -Oliver Rotary Steel Filter, 3' x 1'.
- 1—Oliver Rotary Steel Filter, 3' x 1'.

  CENTRIFUGALS

  1—A. T. 6 M. 40" Rubber Lined Center Siung Centrituge, Perforated Basket with Explosion Proof Motor.

  2—A. T. 6 M. Stainless Steel Suspended Type Centrituge, 84" Imperforated Baskets with motors.

  1—A. T. 6 M. Stainless Steel Suspended Type Centrituge, 54" Imperforated Basket with motors.

  1—Tolhurst Stainless Steel Suspended Type Centrituge, 40" Imperforated Basket

- -Tolhursi Stainless Steel Suspended Type Centrifuge, 40" Imperfected Basket, Fleicher 40" Whirlwind Centrifuges, Bronze Perforated Basket with Explosion Froof Motors.
  -Fleicher 46" Whirlwind Centrifuge, Florace Perforated Basket with Explosion Froof Motor.
  -Tolhurst Center Slung Centrifuge, 26" Perforated Steel Basket with Explosion Tender Slung Centrifuge, 26" Perforated Steel Basket with Explosion Tolhurst 14" Cetrifuge, Rubber Lined Perforated Basket.

- 1—Sharples Stainless Steel Super D Can-ter, Model PN-14.

  1-Bird Solid Bowl Stainless Steel Con-tinuous Centrituge, 18" x 28".

  6-Sharples #16-Y Stainless Steel Super Claritying Centrituges.
- MIXERS
- AIXERS

  12—Simpson #0 Intensive Mixers "Unused".

  1-Simpson #1 Intensive Mixer.

  1-Simpson #1 Intensive Mixer.

  1-Beadco Stainless Steel Jacketed Double Arm Jacketed Mixer, Sigma Blades, Parkins Steel Jacketed Mixers, Sigma Blades, 100 Gals.

  1-Baker Perkins Stainless Steel Jacketed Mixers, Sigma Blades, 100 Gals.

  1-Covagnarro Looms Stainless Steel Jacketed Vacuum Mixer, Fish Tail Blades, 100 Gals.

  1-Baker Perkins Jacketed Mixer, Sigma Blades, 30 Gals.

  1-Baker Perkins Jacketed Mixer, Sigma Blades, 30 Gals.

  1-Readco Jacketed Vacuum Mixer, Sigma Blades, 2½ Gals.

  3-J. H. Day Mogul Vacuum Mixers, Sigma Blades, 2½ and 5 Gals.

  1-J. H. Day Jacketed Powder Mixer, 5000 Lbs.

  2-T. Lboy Jacketed Powder Mixer, 5000 Lbs.

  2-T. Lboy Steel Jacketed Mixers, 700 Gals.

  2-T. Lbosteel Jacketed Mixers, 700 Gals.

  2-T. Lbosteel Jacketed Mixers, 700 Gals.

  2-T. Lbosteel Jacketed Mixers, 700 Gals.

- PULVERIZERS—GRINDERS—MILLS

  1-Mikro #3TH Mikro Pulveriser with 30
  HP Motor.
- HP Motor.

  I-Mikro #2718 Pulveriser, Stainless Steel & Bronse Construction, with Motor.

  -Mikro #1818 Pulverisers with Motors.

  I-Mikro Bantam Pulveriser.

  -Ball & Jewell #2 Stainless Steel Retary Cutter.

  -Ball & Jewell #2 Rotary Cutter.

  -Blaw Knox Air Mill Pulveriser.

  -Blaw Knox Air Mill Pulveriser.

  -Stain #2 Air Mill Pulveriser.

  -Stain #3 Air Mill Pulveriser.

  -Blaw Knox Air Mill Pulveriser.

  -Blaw Knox Air Mill Pulveriser.

  -Blaw Knox Air Mill Pulveriser.

  -Stain #5.

- 5' x 4'.

  Smidth Iron lined Tube Mill, 4' x 12'.

  Gruendler #24-40 Hammer Mill.
- AUTOCLAVES—KETTLES—TANKS
  2-Blaw Knox Steel Jacketed Autoclaves,
  300 & 500 Gals. Cap., Working Pressure 500 Lbs.
  -Patternon Steel Jacketed Autoclaves,
  900 Gals. Cap., Internal Pressure 120
  Lbs.
- Lbs.
  Stainless Steel High Pressure Auto-clave, 10 Gals. Cap., 250 Lbs. Internal Pressure.

  Combustion Engr. Stainless Steel Jacketed Autoclave, 500 Gals. Cap., 300 PSI.
- -Stainless Steel High Pressure Auto-clave, 160 Gals. Cap., 250 PSI.
- Glascote Glass Lined Jacketed Vacuum Reactor, 1800 Gal. Cap., "Unused".
  Picudier Glass Lined Jacketed Vacuum Reactor, 500 Gals. Cap.
  Beacher, 500 Gals. Cap.
  Keitles, 380 Gals. Cap.
  Keven Steel Mixing Tank, 1200 Gals. Cap.
  Keven Steel Mixing Tank, 1200 Gals. Cap., with Netto Drive, 10 HP Explosion Proof Motor, Turbin Agliator.
  Artesiam Steel Jacketed Kettig, 1,000 Gals. Cap., with Rake Type Agliator.
  ASME Code, 50 Lbs. Pressure.
  LP. Powne Jacketed Vacuum ReLeon Steel Jacketed Vacuum ReLeon Steel Jacketed Vacuum ReLeon Steel Jacketed Kettle
  Type C, 10 Gals. Cap., 125 Lb. Jacketed.
  Butfalo Steel Pressure Tanks, 1,000 6

THE GELB GIRL SEPT. 1952

- eted. Buffalo Steel Pressure Tanks, 1,000 & 10,000 Gais. Cap., 100 & 125 PSI, ASME
- Coded.

  2-Steel Storage Tanks, 8,700 Gals. Cap.
  Each. 80 PSI.

  10-Steel Fermenting Tanks, 1300 Gals.
  Each, with Coils & Aquators, 80 PSI.

  23-Steel Storage Tanks, 9,000-17,500 Gals.
- Cap.

  1—Steel Rubber Lined Storage Tank, 4,500
  Gals. Cap.

CHEMICAL, RUBBER, OIL, PLASTIC and FOOD PROCESSING MACHINERY UNION, N. J. STATE HIGHWAY No. 29, UNionville 2-4900



# **Every Day Is Labor Day** Without ADEQUATE EQUIPMENT

Eliminate Labor headaches, cut manufacturing costs, increase production by mechanizing. Under the FMC Rental-Purchase Plan, you make no capital investment; the equipment pays for itself. STAINLESS Flash Tank, 6" x 6" with stainless tube bandie, print available, the bandie, print available, with rubber-lined valves. Croil-Reynolds Vacuum Evaporator in Monel, 3" x 5" with 2 Stage Evactod 400 aal. Reactor, Plaudier Glass-Lined Jacketed 400 aal. Reactor, 2" Plaudier Glass-Lined Jacketed 400 al. Reactor, 2" Plaudier 30 aal. Jacketed Asitated Kettles. Duffows, 30 al. Jacketed and Agitated Kettle.

Kettle. MONEL 250 gal. Jacketed and Agitated Reactor with access.
Stainless Reactors from 24" x 40" to 46" x 60".
Typo 347 Stainless Reactor 18" x 24"; Jktd. and Agita. Agitá: Saintes Lab. Autoclave 10" x 15"; Agitd., Jktd.; 3.000 PSI. 2.000 gal. Copper Coll Heated Vacuum Pan; 7' x 10'7". 10"7". Type 347 Stainless COLUMN: 16 sections: 8%" x 19' high. Goslin Birmingham Steel Sextuple Effect Evap-

Goslin Gollin shim.

Gollandruple Effect Long Tube Film Type Swanoon Single Effect Cast from Evaporator; 130 ss. ft.

Swanoon Jacketed Crystallizers; 24° x 10' and 21° Film Febber 19° Film Film Febber 19° Film Feb

Board Davis Rotary Vasuum Filter 6' x 3'; nicker contact; contact; laker Porkins 50 gals. Double Arm Jacketed Mix-ris HP, 25 st. 57 AlNLESS Double Arm Jacketed Mix-ris HP, 25 st. 57 AlNLESS Sigma Mixer; 6' x 12'; HP XPL moter.

'A, P. type 100 gal. working Jacketed Double 'A, P. type 100 gal. working Jacketed Double doas Double Arm Mixer; 16' x 16' x 12'; double geared; 3 HP, 25 All public Mixer; 18 hP, 25 and 18 and 1

with accessories. Stokes 16 Shelf Steam Heated Dryers; 3' x 3', 6'10" Herizontal Dryers with tracks; 66" x 14"7" long: 21/2" steam pipe.

FRED R. FIRSTENBERG, Pres.

FIRST MACHINERY CORP. 157 Hudson Street, New York 13, N. Y.

#### LARGE STOCK MACHINERY at OUR BROOKLYN WAREHOUSE

SPECIAL:

2-Buffalo 6' dia. Vac. Jacketed, Cast Iron Crystallizers, 300 gals.

De Least States Control of the Contr

i—Robinson 22" Attrition Mill.

i—Lehman 4 Roll W. C. 12335" Steel Mills.

5—Lehman 6 Roll W. C. 12335" Mills.

5—Lehman 6 Roll W. C. 12335" Mills.

5—Lehman 6 Roll W. C. 12335" Mills.

5—Lehman 6 Roll Mills.

1—6" x 24" 3 2" Double Steel Roller Mill.

1—6" x 24" 3 2" In high steel Roller Mill.

1—6" x 24" 3 2" In high steel Roller Mill.

Abbe & Patterson Pablic & Ball Mills.

4—Ball & Jowell & Leoninster Roller Mills.

4—Ball & Jowell & Leoninster Roller Otters.

2—U. S. & Pathyrop & S. CEPENN Mills.

10—Drv Seiral Mixers 50 to 25007.

12—Portable Elec. Liquid Mixers ½ to 3 MP.

4—French Dil Linseed & Cottonseed Hydr. Presses.

Gould 75 MP. Contrilegal Pump. 250 PS1.

4—Frarel 2 hall Richard Pump. 250 PS1.

8-Web 5" x 12" Lah Mixing Mills and Calenders.

4—Farrel 2 hall Richard Mills and Calenders.

4—Farrel 2 hall Richard William Calenders.

4—Farrel 2 hall Richard First Hills.

5—Richard & Plastic Extruders 1 to 5.

1—Marco 200 Stainless Steel Homeelmizer.

1—Stoke & Smith & Dav Powder Filbers.

5—Filling Machines. Liquid Parts & Enlis.

6—Filling Machines. Liquid Parts & Enlis.

7—Hove Mogul Barrel Bag Packers.

2—Revolving Pans 30" & Lumns.

2—Revolving Pans 30" & Lumns.

5—Overine & Buffall Vas. Pumps.

6—Overine & Buffall Vas. Pumps.

6—Overine & Buffall Vas. Pumps.

6—Overine & Buffall Vas. Pumps.

6—Pisatics. injection Modding Machines.

Boilers, Gat. Oil & Coal Fired. Roller conveyor.

WE BUY YOUR SURPLUS MACHINERY & COMPLETE PLANTS PARTIAL LISTING, WRITE FOR BULLETINS, PHONE WORTH 2-5745

### STEIN EQUIPMENT COMPANY

90 West Street, New York 6, N. Y.

Cable Machequip

# NEW AND GOOD-AS-NEW EQUIPMENT

LOEB & SON

. . 4643 LANCASTER AVE. . . . PHILADELPHIA 31, PA.

# STORAGE TANKS

-Prompt Shipment-

GLASS LINED TANKS — USED — 2000 gallon capacity. Welded construction—Fully insulated. Equipped with manhead. Suitable for milk, food products, lily white chemicals, solvents and fine lacquers.

VARNISH TANKS—USED—54" diameter x 14'6" high (or long) 4," Steel — Welded construction — 1700 gallons.

MISCELLANEOUS TANKS-Various sizes

ERMAN-HOWELL DIVISION **LURIA STEEL & TRADING** CORP.

332 South Michigan Ave. Chicago 4, III. Telephone: Wabash 2-0250

ROTARY DRYERS 2—70" x 35' Ruggies Coles A-10. Single Shell: 4x20, 4x45, 5x30, 6x35, 5%x7x60.

MISCELLANEOUS EQUIPMENT
Hammermilla: Jedfrey 36 x 26 B & 43 x 36 FixstoothWilliams 60 Aul. Type 1.R. Magnetic Separator.
E. 107 & 167 Mechanical Air Separators.
E. 107 & 167 Mechanical Air Separators.
E. 107 & 167 Mechanical Air Separators.
E. 408 & 408 & 7 x 6 B and Mills.
E. 50 & 21 Raymond Automatic Pulveriner.
E. 455 & 408 & 564 x 70 & 7 x 6 B and Mills.
E. 50 & 21 Raymond Automatic Pulveriner.
E. 455 & 408 & 4 MISCELLANEOUS EQUIPMENT

WORLD'S LARGEST INVENTORY OF THE ELECTRIC EQUIPMENT CO. P O BOX 51 ROCHESTER 1 N Y

STANHOPE, 60 E. 42nd St., N. Y. 17, N. Y.

# FOR SALE—WE OWN IT OR CONTROL

#### COLUMNS-STILLS

- 2 Aluminum Bubble Cap Columns, 38" dia. x 45 plate.
- 1 Aluminum Bubble Cap Column, 27" dia, x 18 plate.
- 1 Aluminum Perforated Plate Column. 28" dia. x 36 plate. 1 Copper Bubble Cap Column, 42" dia. x
- 31 plate. Copper Bubble Cap Column, 30" dia, x
- 22 plate. Copper Column with 18-30" dia. perforated plates and 10-24" dia, bubble cap plates.
- 1 Copper Sieve Plate Column, 30" dia. x 22 plate.
- Copper Perforated Plate Column 24" dia. x 14 plate.
- Steel and Cast Iron Bubble Cap Col-umn, 30" dia. x 62 plate.

  1 Stainless Steel T316 Raschig Ring
- packed column, 24" dia. x 6'8" high.

  1 Stainless Steel T316 direct fired Vacuum Still, 325 gal.

#### CONDENSERS-EXCHANGERS

- 3 Aluminum tub, 186 sq. ft.
- 16 Alum. Coll Exch. 96 sq. ft. 6 Copper tub. 65. 95, 135, 330, 420, 487. and 725 sq. ft.
- 2 Stainless Steel tub. 8½ & 39 sq. ft. 4 Stainless Steel Coil Condensers, 40 sq.
- ft., 60# pr.

#### DRYERS-EVAPORATORS

- 1 Stokes #59A Jacketed Vacuum Rotary
- Dryer, 18" dia. x 42" long.

  2 Atm. Double Drum Dryers, 22" x 38".

  1 Cummer Rotary Hot Air Dryer, 46" dia.
- 1 Struthers Wells Evaporator, 100 sq. ft. tube bundle.

#### FILTERS

- 1 Sweetland #10, 21 lvs. 1 Sweetland #5, 30 lvs.
- Swenson Rotary Continuous Vacuum Filter; Precoat type, 8' dia. x 8' face, rubber covered and lead acid proof construction.
- FEINC Rotary Vacuum Filter, string dis-charge, 4'6" dia, x 6' face, aluminum.
- 1 Ertel Bronze Disc Filter, 90 sq. ft. 4 Pressure Leaf Filters, 70 to 90 sq. ft.
- 15 Filter Presses, Cast Iron:
  - 4 Shriver 36" rubber covered, closed dely., washing.
- dely, washing.

  1 Shriver 30" rubber covered.

  1 Shriver 30", 35 rec. pl., open dely.

  1 Shriver 24", 40 ch., open dely, wash.

  1 Shriver 24", 24 ch. closed dely.

  1 Sperry 24", 15 rec. pl., open dely,

  1 Shriver 24", 28 ch., closed dely.

  1 Shriver 24", 22 ch., closed dely.

  1 Shriver 24", 12 ch., cl. dely, wash.

  1 Louisville 8-roll Continuous Fliter or Grains Press 24"

- KETTLES-REACTORS 1 7 gal. Nickel lined Autoclave, agit. 1 Stainless Steel, Type 347 Autoclave or
- pressure tank; 250# pr., Elec. heated 850° F; 17¼" dia, x 9' high,
- 70 Stainless Steel and Stainless Clad open top, steam jacketed kettles-10. 40, 60, 80, 100, 150, 250, 500 gal, sizes.
- 1 Stainless Steel Kettle, 950 gal., 20# jkt. pr., vertical agitator, Type 347 shell, bolted C.I. top.
- 4 150 gal. Stainless Steel Steam Jack-eted Kettles, open top, with double motion agitators.
- 3 300 gal. T316 Stainless Steel Jacketed Tanks, water jkt, double motion agitators.
- 1 200 gal. Read Stainless Steel Jacketed Kettle, open top, double motion agita-tor, 10 HP motor.
- l 3000 gal. Horiz. Steel Cooker, Vacuum, Agitated.
- 1 4000 gal. Vertical Steel Cooker agitated.
- 2 Aluminum Reaction Kettles, Jktd. &
- Agit., 60 & 100 gal. 2 Copper Jacketed Agitated Vacuum Kettles, 4' dia. x 4' deep, double mo-

#### MILLS-PULVERIZERS

tion agitator.

- l Paul Abbe #6 Pebble Mill, porcelain lined, 32" x 36".
- 1 Abbe #4A Pebble Mill, 45" x 48".
- l Hardinge Conical Ball Mill, Steel Liner, 4'6" dia. x 24" long,
- 1 Williams Hammer Mill, type AK; size A. stainless steel.
- 3 Mikro Pulverizers, #1-SH, #2-SI, #2-TH
- 1 Premier Colloid Mill, type U-3, 6" st. st. rotor.

#### MIXERS-AGITATORS

- 1 Porter heavy duty jacketed double worm mixer—75 gal.
- 1 Dellenberger 100 gal. Heavy Duty Double Arm Mixer, fish-tail blades, iacketed.
- 1 Broughton Powder Mixer, double arm. 50 cu. ft.
- 10 Copper Conical Blenders, 1/2, 1, 7 & 11 cu. ft.

#### JUST PURCHASED

-15,000 gai. Vertical Welded Steel Closed Fermenting Tanks, 80 lbs. W.P., turbine agitator with 40 HP motor; 970 lin. ft. 3" pipe cell. Ex-cellent condition.

- 1 9000 gal. Horiz. Alum. Tank-NEW
- 35 Aluminum Tanks, closed, 4, 275, 330, 480, 500 & 1350 gal.
  2 100 gal, Glass Lined Vacuum Tanks.
- 15 Horiz, Welded Steel Tanks, Lastiglas
- Lined, 15,200 gal. 9 Horiz. Welded Steel Tanks, Lastiglass Lined, 5800 gal.
- Vertical Welded Steel Tanks, closed Mammut Lined, 7700 gal., 7000 gal. &
- 2300 ggl. Vertical Rubber Lined. 6000 gal, open Vertical Jacketed Pressure Tanks— steel—30# steam jacket—6mm vac-
- uum internally: 3—34" ID x 15' H (approx. 700 gal.) 1—23" ID x 10' H (approx. 230 gal.) 1—23" ID x 9' H (approx. 195 gal.)

#### STAINLESS STEEL TANKS

- STAINLESS STEEL TANKS
  16.200 gail vert, closed, 7304—NEW
  5700 gail vert, closed, 7304—NEW
  5700 gail vert, closed, 7304—NEW
  24200 gail vert, open, 7302—NEW
  1400 gail, vert, open, 10° L x 57° W
  x 57° D
  1000 gail, vert, 7304—NEW
  570 gail, vert, 7304

#### MISCELLANEOUS

- 1 Bird Suspended 48" Steel Centrifugal, Perforated basket; Bottom discharge.
- l Fletcher 30" Jr. Centrifugal Extractor, St. St. Imperi. basket. 1 Sharples #16 Super Centrifuge. stain-
- less steel.
- 5 DeLaval Centrifuges, models #600, 74-11 and 94-01.
- 1 Delonizing System, 500 GPH. Zeolite.
- 2 Kux Machine Co. Model 25 Retary Pellet Presses, 21 and 25 punch—with motor and vari-drive.
- 6 Stokes Rotary Pellet Presses, 16 punch B-2, D-3, D-4.
- 1 Byron Jackson Deep Well Pump, 150 GPM 325' head, NEW.
- 4 Selectro Vibrating Screens, stainless steel, 2' x 7', double deck, enclosed.
- 1 Stainless Steel Horizontal Sterilizer or Steam Retort. 10# pr., 24"W x 26"H x 36"L.
- 1 Stokes Vertical Steel Jacketed Vacuum Chamber and Impregnating tank, 30°L x 24"W x 24"D.

STAINLESS STEEL FABRICATION We have in stock a quantity of Stainless Steel sheets: Type 304—12 gs., 14 gs., and 10 gs. Tonks, receivers, etc. fabricated to your specifications.

Write: Attn. Fabricating Division.

1413 N. 6th ST. PHILA. 22, PA.



PHONE STEVENSON 4-7210

CABLE-PERI

# The Right Quality ... The Right Price

\* Rebuilders for 25 years. Your logical source for processing equipment.

#### PARTIAL LIST-Send for complete listing

- PARTIAL LIST—Se

  1-5' x 36" Hardings
  burstone lined continuous Pebble Mill.
  3-5' x 12" Buflovac doubie drum Atmospheric
  Dryers.
  1-30" Tolhurst imperior
  ate basket suspended
  Centritugal.
  1-23 qgt.
  1-23 qgt.
  1-23 qgt.
  1-24 Farral-Birmingham 2-roll Rubber
  Mill with 25 hp. drive.
  1-New 3000 qgl. vertical
  S.S. Storage Tank.
  1-Bullovac triple effect
  Evoporator, 300 sq. ft.
  per effect.
  1-Plaudler cuum Pan.
  2-Devine S-shell 42" x
  42" vacuum shelf Dry42" vacuum shelf DryNew Simpson ±00 In-

- ers.
  New Simpson #00 Intensive Mixers with S.S. bowls and plows.

**WE BUY • WE SELL** 

Single items

Complete Plants Phone BRunswick 8-5326

"IT PAYS-TO TRADE-WITH LOEB"

- nd for complete list.

  5-3000 gal. Picualler
  jacketed glass lined
  (dairy) vertical Tanks.

  50-Stainless steel Tanks
  (New and Used) up to
  1000 gallons.

  30-S.5 steam (and used)
  up to 150 gallons.

  4-I. H. Day 40 gallon
  Pony Mixers.

  12-Filter Presses recessed and plate and
  irame-from 7" to 30".

  12-Gy 20 gal. Stokes S.S.
  Vacuum Pan.

  12-Day 300 Mixers.

  5-Day 12 x 32" 3-roll
  Mills.

  3-Double drum Atmospheric Dyers-42 x
  120", 32 x 50", 24x60",
  6-6 x 40 Rotary Hot Air
  Dryers.

   Dry Powder Mixers.

   Dry Powder Mixers.

   Ballovan 3000 h. car.

  1-Ballovan 3001 h. car.

  1-Ballovan 3001 h. car.

   Ballovan 3-shell 12 x
  42" Vacuum Shell

- 9

  1—New Ing-Rand 14" x 7" Vacuum Pump.

  1—Harris 6" stainless steel Vacuum Pan.

  1.—New Premier 3" stainless steel Colloid Mill with 7½ hp. motor.

  1.—Charlotte M-15 stainless steel Colloid Mill with 15 hp. motor.

  2.—Union Steam Pump stainless steel Reciprocating Pump, 86 GPM.

  2.—De Lavau 54-81 motor driven Clarifiers.

  3 hp. —Clarifiers.

  3 hp. Lanaguese.

- airtight, stain. steel, 3 hp.
  Steel Tanks—2000 gal. heavy duty steam jacketed, open top.
  Agitators: Netto WT27, stain. steel turbine
- type.
  -Disintegrator: Rietz 40
- hp.

  Evaporator: New stain.

  steel, 3000 lb. per hr.
- evaporation.

  Vacuum Pan: 26" Mojonnier stain, steel.

  Intensive Mixers: Simpson 24" double muller, motor driven.

EQUIPMENT SUPPLY CO.

1927 WEST NORTH AVE. CHICAGO 22



#### FOR SALE

Available for prompt delivery, new Cast-in Coil Kettle, 5'0" dia. x 6'2" deep dished bottom, at a reduced price. Kettle designed for 40 PSI and tested to 80 PSI hydrostatic pressure. Kettle equipped with 7 sets of coils.

#### **Buflovak Equipment Division** of Blaw-Knox Company

1543 Fillmore Ave., Buffalo 11, N. Y.

### SURPLUS EQUIPMENT

#### Latest Type Metallurgical and Chemical Equipment Excellent Condition

Hardinge Conical Ball Mill 10' x 48" Link Belt Screw & Belt Conveyors Vulcan Rotary Kiln 8' dia. x 80' Research Corp. Electrostatic Precipitator Norblo & Sly Dust Collectors Ruggles-Coles Class XA-1 Dryer **Dorr Causticizing Equipment** Oliver Rotary Vacuum Filters Al

Dorr Type A Thickeners

Turbo Mixer Agitators

Hardinge Feedometers

Oliver, Dorr, Morris, Worthington process pumps Tanks and Bins

Sampling Mill-Crusher, Rolls, Samplers Instruments and Controls

The above items include all auxilary equipment with individual motor and control 220/440/3/60. The equipment may be inspected on foundations.

Complete List with Specifications Available.

#### THE VULCAN DETINNING CO. SEWAREN, N. J.

## ACCUMULATOR AND PUMPS

- 1-7" x 6' inverted accumulator, Mf's. by Chas. Elmes Eng. Wks. 37" dial shell. Takes 11,000# ballast for 300# W.P. Max. Work. height 15'-11"., 2" pipe conn. to spindle,
- 2-Worthgton. 4-1/2" x 6" vert. triples single acting pumps. 300# P.S.1., motor drive, less motrs, bronze trimmed, new 1943.

#### DALTON SUPPLY CO.

2829 Cedar St.

Phila. 34, Pa.

### ROTARY VACUUM FILTERS

IMMEDIATE DELIVERY

3' dia. x 1' face, 10 sq. ft. filtering area, complete with all drives, motors and accessory units. Type 316 stainless steel. String or scraper discharge. Used, but in excellent condition. A few new units also available.

FILTRATION ENGINEERS, INC. 155 Oraton St. Newark 4, New Jen ton St. Newark 4, New Jersey
Phone: HUmboldt 5-4444

# Saunders Diaphragm. Stainless. 11/2". Style 508. NEW 30% off No. 24190. NEW 50% off Lapp "Y" Porcelain. 3" Cat. 2" C25/71. NEW 40% off Many other valves. New & Good used. Many other valves. New & Good used. PUMPS Byron-Jackson "PUP" Pump. Heavy Duty. With 8 cylinder Chrysler enjine. New War Surplus. Guaranteed Silver Pump. Bods. Pressure Blower Pumps Rods-Connerville Pos. Pressure Blower Pumps 20%, or with 2 HP 220/440 V. Metler. New. 20%, or with 2 HP 220/440 V. Metler. New. ANKS: 3,000 Gal glass lined. Plaudler = 3334 or Equivalent. Used. Enjine Driven GENERATOR SETS. Reconditioned & Guaranteed. Up to 2,500 KW. Let us know your emergency power requirements. HARBER INDUSTRIALS

### All offerings are subject to prior sale and are FOB Chicago 2 NEW STEEL TANKS

3520 W. Ogden Ave. Chicago 23, Illinois

350 Gal. Capacity:
'%" Steel plate with %" dished heads.
42" dia. x 6' 0" long.
0ne-1%" and three 2" couplings
Good for 150 pound pressure

SOHL MFG. CO.

Phila. 25, Pa.

# GENERATORS

Heavy Power Equipment Industrial - Chemical Process

Equipment NEW - RECONDITIONED - USED

DEAN G. STRICKLER & ASSOCIATES 1346 Cennecticut Avenue, N.W. Weshington 6, D. C. - DuPent 3386

# **OPPORTUNITY!!!**

We have just purchased the entire machinery and equipment of:

## WILLIAM J. McCAHAN SUGAR REFINERY. PHILADELPHIA, PENNA.

We are liquidating this equipment and offer, subject to prior sale:

- 7—VALLEZ Rotary Filter Presses, type #4 & #4 SR, with Stainless Steel
- Triple—Effect LILLIE vertical EVAP-ORATOR, Cast Iron, 7'4%" dia. x 12' high, with 406-2" copper tubes each effect, including BRONZE pumps, condensers, etc.
- 1—Triple-Effect LILLIE horizontal Evaporator, Cast Iron, 60" dia. x 9'0' long, with 106-3" copper tubes each
- effect, including pumps, condenser,
- 77-40" dia. American Tool Works. (Robert's Patent) Centrifugals, with
- bronze baskets, belt-driven. 6-ALL-COPPER Ca landria Pans & Evaporators, 14' x 12' dia., complete
- with catchalls, condensers, etc.

  1—ALL-COPPER double-effect Evaporator, 78 5" dia., vertical with condenser, fittings, etc.
- 1-10' dia. Cast iron Calandria Pan, complete with catch-all, condenser, Guild-Garrison Pump, fittings, etc. 8—CAST IRON BLOW-UP Tanks, 8' dia.
- x 8' deep.
- HERSEY GRANULATORS, 5' & 6' dia. x 23' long, with gear reducers. heating coils, etc.
- 45-10' dia. x 20' high Round vertical CHAR Filter tanks. (West Point Fdy. & Mch. Co.) Cast Iron, 11/4" thick.

ALSO: Crystallizers, Attrition Mills, Crushers, Conveyors, Packaging and Weighing Mchs., Bag-Stitchers, Scales, pallets, copper & steel pipe, valves, etc., ITEMS too numerous to mention!!

NOTE: ALL equipment on foundation in above plant, offered at approx. 40% of TODAY'S COST!!! Call Mr. Hunt

# L. BLUMBERG'S SON. INC.,

Robbins & Delaware Aves.

Phone: Deveregux 2-1444-5-6

Phila. 35, Pa.

#### FOR SALE NEW NEVER UNCRATED

- 1—18" Raymond vertical Mill Fabricated Steel Const. with water jacket. 2'6" cyclone collector and connecting pipe but without feeder, feeder drive motor, main mill motor or mill drive.
- 1—30" Double Whizzer Raymond Mechanical Air Separator complete with motor. T.E.F.C. 3 H.P. 1715 R.P.M. 60 cy., 220/440 volt.

CARBOLOY DEPARTMENT OF GENERAL ELECTRIC COMPANY Attention Purchasing Dept. Box 237, Roosevelt Park Annex Detroit 32, Michigan

> FOR SALE 600 ft. of New Carlon PLASTIC PIPE

Complete with couplings and clamps. Priced at 35 original cost for immediate shipment. ROBERTS & SCHAEFER COMPANY 130 North Wells Street Phone—Central 6-7292

#### TRADE WITH BAUER BUY - SELL - TRADE COMPRESSOR HAM BOOSTER L.W.BAUER



### LIQUIDATING TWO STARCH PLANTS

JUST PURCHASED FOR STOCK

All of the equipment listed was purchased new by Northwest Chemurgy Corp. for their plants at Hatfield, Calif and Wenatchee, Wash. Much of it was never used. All equipment is in perfect condition.

Vallez Rot. Leaf Filter. 31 Lvs on 4' centers ADT Rot. Steam Tube Dryer, 5' Dia x 30' long Krenz St. Steel Voz Pan, 6' dia x 12' on str sd Monel Tk., Vac cr Press 6' dia x 12' on str sd Monel Tk., Vac cr Press 6' dia x 12' on str sd Eimco 8'x8' Ret Vac Filt., Intest type, comp. 3—Acme Cop. Vac Pans, 7'x10' 5'x6', 5'x10' Buck. Elev., 25' high, bucket 12xxx6, GM Hammermill with 40 HP mot., screw infeed & honor.

hoppr
Screw Conv., 10"x12". Gearhead motor drive
Redwood Tanks (new) 1500 of 10,000 gallons
ADT Trommel Screen, 3" dia v 12" long w/mot
ADT Do-Watering Screen with hopper feeder
& Motr
Louisville De-Watering Screen with motor dr
=—Smithway Rotary Screens, 4" dia 12" long
34—Smithway Rotary Screens, 4" dia 12" long
134—Smithway Shak. Screens, 1" dia 7" 6" high
1-2" Stakes Condenser, 2" dia x 7" 6" high
Tyber 36" 32" with 36" recessed plates
Richardson Scale with Variable Feeder & hopr

Multiclone Dust Col. size 25-5 type 9-VD 2—Rotex Model 52 Sifters, 2 deck 5'10' 5 HP 3—Morts 1 to 75 HP, many geardh all sizes Buflovac 2-Drum Dryer, 42''x 108'' Tyler Nigg 1 Deck Screen 36''x72''. 3 HP mot Worthington Vac Pump, piston type 18''x8'' Miscellaneaus; Pumps, Motors, Conveyors, Tanks, Pipe & Fittings, Belting, Gauge Glasses, Ventilators, switches and thousands of small items, Send your inquiry!

BUILDING FOR SALE

Reinforced concrete 2½ stories, cement floors 12,500 Sq Ft area, brand new. Location Tulelake, California. Yours for cation Tulelake, Cal 15% of todays cost!

BARGAIN PRICE

OVER 10,000 ADDITIONAL ITEMS IN STOCK

### MACHINERY AND EQUIPMENT COMPANY

514 Bryant Street . San Francisco 7, Calif.

#### 1 HERCULES-SEITZ # 12 FILTER

12 frames—perfect condition also 2 Beach Russ vacuum pumps. Very reason-

MYER 1890 DATED BEVERAGES, Inc. 29 Mangin St., New York 2, N. Y.

#### FOR SALE

I—Four Effect Swensen Evaporator
I—Three Effect Swensen Evaporator with Salt Setting Tanks, etc.
I—Two-Stage Crystallizer
Pumps, vacuum equipment, piping

INSPECTION INVITED MANGANESE, INC. Box 2000, Henderson, Nevada

# DAVIS Solenoid -

**VALVES** 

Built to handle the toughest

JOBS!



Here is a valve that's built to handle tough jobs. Completely sealed valve mechanism makes for safe handling of toxic or inflammable fluids or gases. Self-cleaning design due to simple interior large port area and downward outlet that allows natural gravity flow. Also has explasion proof housing for coil, renewable valve disc and visible action. Ideal for accurate control of fluids under tough conditions. Less maintenance required and longer, more ecompical service.



No. 93

Davis No. 93 is a self-contained, pilot operated, single seated, tight closing valve, built with full port opening to insure maximum flow with minimum pressure drop. Action is visible—may be operated by hand if current fails. Renewable valve disc. Sizes ½" to 4". Suitable for control service on steam, air, gas, water or oil lines.

DAVIS Solenoid Valves are engineered to handle your toughest control jobs. Don't confuse them with ordinary commercial types. Davis guarantees satisfaction! The Davis Solenoid line is complete—standard and special designs are available for many different kinds of control applications.

The Davis engineering department is always ready to help you solve any problems regarding the use of solenoid valves. When you submit your problem, give us complete information so that the proper valve may be selected for the service. State the size of valve, pattern (globe or angle), nature of fluid or gas, temperature, maximum and minimum pressures, service use, whether valve is to be open or closed when energized, standard or explosion proof solenoid box and current characteristics.

# WRITE FOR A COPY OF THIS BULLETIN

Complete details and specifications on Davis' complete line of solenoid valves. Includes information on operation, applications and valves recommended for various

kinds of service.





# HIGH SPEED MILLS WILL CUT YOUR PRODUCTION COSTS



THREE ROLL MILLS
prove time and again to give
maximum output with highest quality
grinding or dispersion results.

The ease of operation, increased production features, and rugged construction of ROSS mills are worth investigating to see why ROSS is the leading mill in plants throughout the country.

Compare these features built into every ROSS Mill:

- Highest grade rolls precision ground and tested for maximum hardness. Thin wall construction with large full length cooling chambers.
- 2. Increased roll speeds for higher production with special differential speeds for maximum shear.
- speeds for maximum shear.

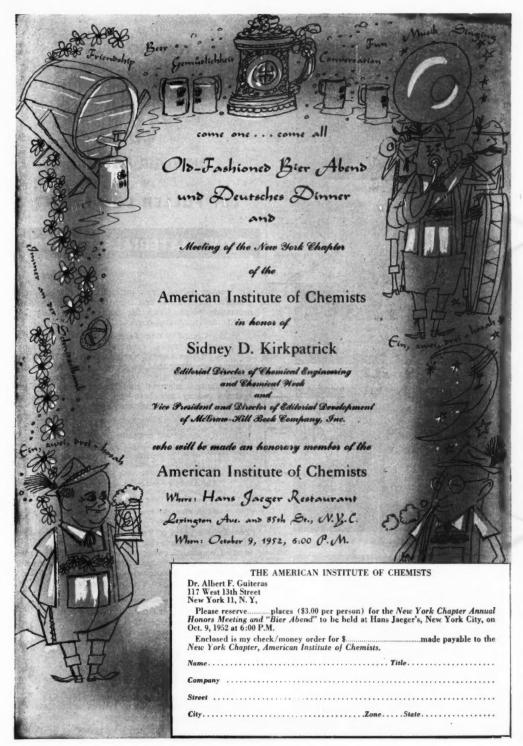
  3. Newly designed hopper quickly adjusted or removed for cleaning. Dual adjusted end plate regulator optional.
- Solid one piece cast iron frame eliminates vibration, assures rigidity and perfect roll alignment under all conditions.
- 5. Motor mounted inside mill frame.
  Two speed motors when required.
- 6. Extremely quiet operation with heavy SKF self-aligning roller bearings throughout and helical gears operating in continuous oil bath lubrication.
- Balanced apron prevents scoring of rolls. Uniform pressure of thin razor knife gives clean takeoff without heating.
- 8. Special bearings in handwheels facilitate rapid setting or disengaging of rolls. Parallel settings obtained with indicating dials for sensitive accurate adjustment. Setting is direct, has no intermediate wearable parts, will not lose effectiveness or accuracy.

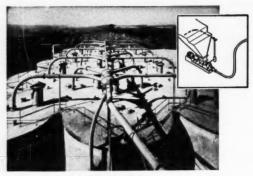
Available in 4½×10, 6×14, 9×24, 12×30, 14×32 and 16×40 inch sizes. Write for further details!

Information on our guaranteed reconditioning service for mills of all types on request.

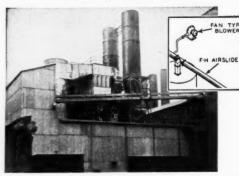
### CHARLES ROSS & SON COMPANY

152 CLASSON AVENUE BROOKLYN 5, N. Y.

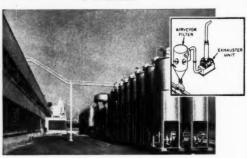




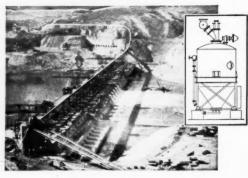
Fuller-Kinyon System



F-H Airslide



The Airveyor



Fuller-Fluxo System

#### WHY NOT PUT



#### ON YOUR PAYROLL

#### LET FULLER EQUIPMENT

### FLOW MATERIALS FOR YOU

Air conveying of dry, pulverized, crushed, and granular materials to and from carriers, storage and processing points has made manual movement obsolete, inefficient and costly.

Fuller Company manufactures four basic types of pneumatic conveyors, each with its own unique features, to meet specific requirements. All Fuller systems are designed for flexible application—especially in plants where building layout and design create unusual material handling problems. Fuller systems convey anywhere—up, down, horizontally, around corners, overhead, underground.

Fuller-Kinyon Conveying System—conveys dry, pulverized materials to and from cars, ships, storage and processing points.

F-H Airslide—flows dry, fine materials, fluidized with low-pressure air, down slightly inclined channels. Dust-proof. No moving parts. No lubrication.

The Airveyor—transports dry, granular or crushed material to and from carriers, storage areas and processing points.

Fuller-Fluxo System-moves dry, pulverized material, economically over long distances.

Twenty-five years of Fuller experience in all phases of pneumatic conveying go into every engineering study (proposal drawing and estimates) which shows how you can solve your material handling problem, efficiently and economically. It will be submitted for your consideration without charge or obligation.

FULLER COMPANY, Catasauqua, Pennsylvania Chicago 3—120 So. LaSalle St. San Francisco 4—420 Chancery Bldg.

## **Fuller**

DRY MATERIALS CONVEYING SYSTEMS AND COOLERS .
COMPRESSORS AND VACUUM PUMPS .

FEEDERS AND ASSOCIATED EQUIPMENT

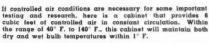
G-75



## HUDSON PULP & PAPER CORPORATION Dept. 131, 505 Park Avenue, New York 22, N. Y.

## HUMIDITY

Within 1° Wet Bulb



Heating and cooling, humidifying and drying, are all controlled automatically and uniform conditions are maintained as long as the unit is in operation. Outside indicators reveal the conditions inside the box at all times.

#### AIRE-REGULATOR

Constant Temperature and Humidity Cabinets are now in use by prominent laboratories in many lines for testing and research. Among the users are food manufacturers of all kinds producing bakery products, flour, pockaged mixes, cheese, yeast, beer, candy and n.eat products; others are manufacturers of pharmaceuticals, photographic supplies, paints and varnishes, chemicals, insulating materials, instruments, box board, poper tope and crude oil products. Wherever there is a need for checking the action of temperatures and humidity there is a need for an Aire-Regulator. Write for bulletins and tell us your requirements.

FOOD TECHNOLOGY INC.

5901 Northwest Highway

Chicago 31, Illinois

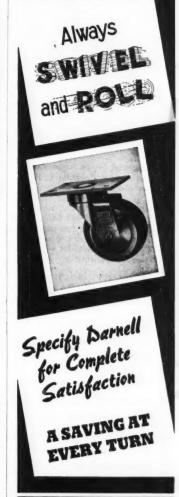
FOOD TECHNOLOGY, INC.

SUNDAY

#### CHEMICAL ENGINEERING—September 1952

WET BULB

## DARNELL CASTERS



DARNELL CORP., LTD.
DOWNEY, (Los Angeles County) CALIF.

60 Walker Street, New York 13, N.Y. 36 North Clinton, Chicago 6, Illinois

## DO YOUR SPRAYS CLOG?



Available in Brass, Stainless Steel and Hard Rubber --- or made - to - order in any ma-chinable material. 1/4" to 1"

Advanced design features a single round tangential inlet (instead of several small slots). Relatively large solid particles can pass right through and out the orifice. Produces a hollow cone spray with fine break-up and even distribution-ideal for many types of applications.

In many industries Monarch Spray Nozzles are used for:

ACID CHAMBERS AIR WASHING CHEMICAL **PROCESSING** COOLING PONDS DESUPERHEATING GAS SCRUBBING HUMIDIFYING OIL BURNERS SPRAY DRYING

> Let us send you Catalogs 6A and 6C

#### MONARCH MFG. WKS., INC.

2517 E. ONTARIO ST. PHILADELPHIA 34, PA.

# of any stock you want to

You will receive an Engineering Report based on our Test Grind with the

### SCHUTZ-O'NEILL PULVERIZER

Do you have a production problem on stocks you grind, to get desired uniformity or fineness? Are you looking for increased output with a cost reducing method? Profit by Schutz-O'Neill's experience of almost 60 years in the rapid, dustless, accurate pulverizing of any dry, non-gritty, grindable stock. Your acceptance of this offer for a test grind does not obligate you. Schutz-O'Neill Pulverizers are made in 6 sizes with capacities up to 3000 lbs. per hour.





chute-O'Neill Gyrator Sifte out a large volume of uni-clean product. I to 3 sieve The finest development of Centrifugal air-force pulverizing For extremely fine grinding and uniformity of product, the principle of centrifugal impact with product carried by the air stream has never been surpassed. Schutz-O'Neili

the fullest degree. Send us stock sample State fineness desired

You will receive your pulverized stock plus our Engineering Report giving recommended equipment, methods and mill plans. Literature upon request.



STABLISHED

SCHUTZ-O'NEILL CO.

PULVERÎZERS - JAREAKER MILLS - ROLLER MILLS

Minneapolis 15, Minnesota

### HERE'S THE ECONOMICAL ANSWER TO YOUR ACID-PROOF DUCT PROBLEMS!

Put New HEIL Solid Plastic Ducts to Work in Your Plant for Longer Service Life.

- 1. Acid Protection Inside and Out. No longer concern about lining failure.
- 2. Easy to Install. Although strong as light gage steel, these ducts are light weight and easy to install.
- 3. Good Chemical Resistance. Will resist practically all chemical conditions-high temperatures too.
- 4. Round or Rectangular. Easy to replace present system.
- 5. Low Initial Cost. Standard designs and production know-how results in lower cost to you.

Sales Representatives in All Principal Cities

#### HEIL PROCESS EQUIPMENT CORP. CLEVELAND, OHIO 12901 ELMWOOD AVE.

ct Sections Ready

WRITE TODAY for Illustrated Bulletins #751 and #754 Solid Plastics

Other Heil Products Include: Impervious Graphite Heating and Cooling Units . Lined Storage and Process Tanks . Acid-proof Mainte- Structural Plastics . nance Materials Steam Jet Agitators

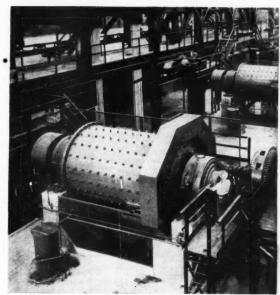
## THIS MONTH . .

**CE** offers

Reprint 25 . . .

## Size Reduction

A lot has happened in this field since our May 1938 special issue on mechanico-chemical processing. Our report will bring you up to date on the selection of crushing, grinding and pulverizing equipment.



## **EVERY MONTH...**

Chemical Engineering provides this convenient coupon method to give you an up-to-date list and faster service on reprints. These are available now . . . in bulk or single copies. Please order by coupon.

- Chemical Engineering's Flowsheets—150 flowsheets of processes (\$1.50).
- 2 Data & Methods for Cost Estimation—38 articles, 128 pages . . . equipment, plants, operations. (\$1.75).
- 3 Bulk Packaging of Chemicals—Developments and trends.
- 4 Fluid Flow-Fifteen authoritative articles. (\$1).
- 5 Water Problem—What it means to chemical process industries
- 6 Fire Prevention—Developments and trends.
- 7 Middle Atlantic States—A survey and census.
- 8 Process Energy—Requirements, costs, improvements in equipment (\$1).
- 9 Product Development—Basic approaches to the problem.
- 10 Crystallization—Equipment and methods.
- 11 Materials of Construction—14th biennial report . . . with directory of materials and manufacturers, (\$1).
- 12 Computers—What high-speed automatic computers are . . . how they can be used.
- 13 Solvent Extraction of Oilseeds—Process principles . . . purification.
- 14 Organic Unit Processes—Review and recent advances.
- 15 Glass-How, where and why it's used.
- 16 Motors & Motor Control—Types, performance, costs.
- 17 Sublimation—Roundup on equipment, technicques, theory.
- 18 Agglomeration—Methods and equipment . . . principles.
- 19 New Processing Tools—Trends and developments . . . equipment, techniques.
- 20 Plant Defense—Control disaster by enemy attack, espionage.

- 21 Pumps—Classification . . . chemical pumps . . . how to select.
- 22 Process Instrumentation—48-p. report, 16-p, folded chart . . principles, advances, selection. (\$1).
- 22a Process Instrumentation—48-p. report . . . economics, selection, push-button plants. (75c).
- 22b Process Instrumentation—16-p. chart . . . Guide to Process Instrumentation Elements . . . features of 350 instruments.
- 23 Liquid-Liquid Extraction—Equipment performance and characteristics . . . solvents.
- 24 Builders of the Chemical Contury—The people who have made chemical engineering in the U. S. . . . industry problems of the future (\$1).

MAIL THIS COUPON
8-52

Editor, CHEMICAL ENGINEERING 330 West 42nd St., New York 36, N. Y.

Name.....

City.....Zone....State.....

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 22g 22b 23 24 25

\* Except as noted above.

## KEEPING UP with ideas in advertising

### ADVERTISERS INDEX

For more information about products of these advertisers, use Reader Sei C-O-Two Fire Equipment Co..... 472

Aerofin Corn	
	357
Airy Flexible Coupling Co. In-	276
Albert Pine Comple Co., Inc.	77
Albert Fipe Supply Co	1530
Acrofin Corp.  Ajax Flexible Coupling Co., Inc.  Albert Pipe Supply Co.  L'Allegheny Ludlum Steel Corp.  Allen Bradley Co.	324
Allen Bradley Co	370
Allis-Chalmers Mfg	241
Allis Chalmers Tractor Div	353
Allen Bradley Co Allis-Chalmers Mfg. 23, 38, Allis Chalmers Tractor Div Aluminum Co. of America 381,	
America	203
Amercoar Corp	22
American Air Filter Co. Inc	225
American Bitumuls & Asphalt Co F	3449
American Blower Corp.	20
American Brass Co	401
American Car & Foundar Co	0.5
American Can & Poundry Co	(3
American Flange & Mrg. Co. Inc	62 175
American Hard Rubber Co	175
Alumnum Co. of America. 381, American Corp	
Div	212
American Metal Hose	86
American Metal Spinning & Stamping	00
American Metal Spinning & Stamping	
00	3779
American Optical Co	12
American Tool & Machine Co	190
Div. American Metal Hose American Metal Hose American Metal Spinning & Stamping Co. Li American Optical Co. American Tool & Machine Co. American Wheelabrator & Equip. The Annin Co. Anti-Corrosive Metal Products Co. Inc. Atlas Mineral Products	58
The Annin Co.	204
Anti-Corrosive Metal Products Co. Inc.	354
Atlas Mineral Products Co. Inc	200
Atlas Mineral Products Atlas Powder Co	
Atlas Powder Co	416
Automatic Switch Co	7331
Babcock & Wilcox Co	
Babcock & Wilcox Co	4-/5
Babcock-Wilcox Co., Tubular Products	
Division	-301
Bailey Motor Co.	22
Baker & Company	204
Barrett Div Alliad Chamical & Due Com	66
Barrett Div. Amed Chemical & Dye Corp.	00
Beckman Instruments Inc.	259
Bernis Bros. Bag Co Bersworth Chemical Co	272
Bersworth Chemical Co.	295
Bethlehem Steel Co	411
Bird Machine Co	9
Dird Machine Co	4
Black Sivalls & Bryson, Inc	14
Black Sivalls & Bryson, Inc	21
Black Sivalls & Bryson, Inc	21
Bersworth Chemical Co. Bethlehem Steel Co. Bird Machine Co. Black Sivalls & Bryson, Inc. Blaw-Knox Co. Blickman Inc. Blockson Chemical Co.	21 266
Black Sivalls & Bryson, Inc.  Blaw-Knox Co.  Blickman Inc.  Blockson Chemical Co.  Boston Woven Hose & Rubber Co.	21 266 303
Boston Woven Hose & Rubber Co.	21 266 303 92
Boston Woven Hose & Rubber Co	21 266 303 92 489
Boston Woven Hose & Rubber Co	21 266 303 92 489
Boston Woven Hose & Rubber Co	21 266 303 92 489 373 219
Boston Woven Hose & Rubber Co. Bridgeport Brass Co. Bristol Co. Brown & Root Inc. Buell Engineering Co.	21 266 303 92 489 373 219 63
Boston Woven Hose & Rubber Co. Bridgeport Brass Co. Bristol Co. Brown & Root Inc. Buell Engineering Co.	21 266 303 92 489 373 219
Boston Woven Hose & Rubber Co. Bridgeport Brass Co. Bristol Co. Brown & Root Inc. Buell Engineering Co. Buffalo Forge Co. Buffalo Forge Co.	21 266 303 92 489 373 219 63 76
Boston Woven Hose & Rubber Co. Bridgeport Brass Co. Bristol Co. Brown & Root Inc. Buell Engineering Co. Buffalo Forge Co. Buffalo Forge Co.	21 266 303 92 489 373 219 63 76 405
Boston Woven Hose & Rubber Co. Bridgeport Brass Co. Bristol Co. Brown & Root Inc. Buell Engineering Co. Buffalo Forge Co. Buffalo Forge Co. Buffovak Enpt. Div. of Blaw-Knox. Budders—Providence Inc.	21 266 303 92 489 373 219 63 76 405 351
Boston Woven Hose & Rubber Co. Bridgeport Brass Co. Bristol Co. Brown & Root Inc. Buell Engineering Co. Buffalo Forge Co. Buffalo Forge Co. Buffovak Enpt. Div. of Blaw-Knox. Budders—Providence Inc.	21 266 303 92 489 373 219 63 76 405 351 415
Boston Woven Hose & Rubber Co. Bridgeport Brass Co. Bristol Co. Brown & Root Inc. Buell Engineering Co. Buffalo Forge Co. Buflovak Eopt. Div. of Blaw-Knox. Builders—Providence Inc. Butler Mig. Co. Byron Jackson Co. 56	21 266 303 92 489 373 219 63 76 405 351 415 6-57
Boston Woven Hose & Rubber Co. Bridgeport Brass Co. Bristol Co. Brown & Root Inc. Buell Engineering Co. Buffalo Forge Co. Buflovak Eopt. Div. of Blaw-Knox. Builders—Providence Inc. Butler Mig. Co. Byron Jackson Co. 56	21 266 303 92 489 373 219 63 76 405 351 415 6-57
Boston Woven Hose & Rubber Co. Bridgeport Brass Co. Bristol Co. Brown & Root Inc. Buell Engineering Co. Buffalo Forge Co. Buflovak Eopt. Div. of Blaw-Knox. Builders—Providence Inc. Butler Mig. Co. Byron Jackson Co. 56	21 266 303 92 489 373 219 63 76 405 351 415 6-57
Boston Woven Hose & Rubber Co. Bridgeport Brass Co. Bristol Co. Brown & Root Inc. Buell Engineering Co. Buffalo Forge Co. Buflovak Eopt. Div. of Blaw-Knox. Builders—Providence Inc. Butler Mig. Co. Byron Jackson Co. 56	21 266 303 92 489 373 219 63 76 405 351 415 6-57
Boston Woven Hose & Rubber Co. Bridgeport Brass Co. Bristol Co. Brown & Root Inc. Buell Engineering Co. Buffalo Forge Co. Buflovak Eopt. Div. of Blaw-Knox. Buflovak Eopt. Div. of Blaw-Knox. Bullet Mfg. Co. Byron Jackson Co.  Cambridge Wire Cloth Co. Cambridge Wire Cloth Co. Carbide & Carbon Chemicals Corp.	21 266 303 92 489 373 219 63 76 405 351 415 6-57
Boston Woven Hose & Rubber Co. Bridgeport Brass Co. Bristol Co. Brown & Root Inc. Buell Engineering Co. Buffalo Forge Co. Buflovak Eopt. Div. of Blaw-Knox. Buflovak Eopt. Div. of Blaw-Knox. Bullet Mfg. Co. Byron Jackson Co.  Cambridge Wire Cloth Co. Cambridge Wire Cloth Co. Carbide & Carbon Chemicals Corp.	21 266 303 92 489 373 219 63 76 405 351 415 6-57
Boston Woven Hose & Rubber Co. Bridgeport Brass Co. Bristol Co. Brown & Root Inc. Buell Engineering Co. Buffalo Forge Co	211 2666 303 92 489 373 219 63 76 405 351 415 6-57 389 69 5
Boston Woven Hose & Rubber Co. Bridgeport Brass Co. Bristol Co. Brown & Root Inc. Buell Engineering Co. Buffalo Forge Co	211 2666 303 92 489 373 219 63 76 405 351 415 6-57 389 69 5
Boston Woven Hose & Rubber Co. Bridgeport Brass Co. Bristol Co. Brown & Root Inc. Buell Engineering Co. Buffalo Forge Co	211 2666 303 92 489 373 219 63 76 405 351 415 6-57 389 69 5
Boston Woven Hose & Rubber Co. Bridgeport Brass Co. Bristol Co. Brown & Root Inc. Buell Engineering Co. Buffalo Forge Co	211 2666 303 92 489 373 219 63 76 405 351 415 6-57 389 69 5
Boston Woven Hose & Rubber Co. Bridgeport Brass Co. Bristol Co. Brown & Root Inc. Buell Engineering Co. Buffalo Forge Co	211 2666 303 92 489 373 219 63 76 405 351 415 6-57 389 69 5
Boston Woven Hose & Rubber Co. Bridgeport Brass Co. Bristol Co. Brown & Root Inc. Buell Engineering Co. Buffalo Forge Co	211 2666 303 92 489 373 219 63 76 405 351 415 6-57 389 69 5
Boston Woven Hose & Rubber Co. Bridgeport Brass Co. Bristol Co. Brown & Root Inc. Buell Engineering Co. Buffalo Forge Co	211 2666 303 92 489 373 219 63 76 405 351 415 6-57 389 69 5
Boston Woven Hose & Rubber Co. Bridgeport Brass Co. Bristol Co. Brown & Root Inc. Buell Engineering Co. Buffalo Forge Co	211 2666 303 92 489 373 219 63 76 405 351 415 6-57 389 69 5
Boston Woven Hose & Rubber Co. Bridgeport Brass Co. Bristol Co. Brown & Root Inc. Buell Engineering Co. Buffalo Forge Co	211 2666 303 92 489 373 219 63 76 405 351 415 6-57 389 69 5
Boston Woven Hose & Rubber Co. Bridgeport Brass Co. Bristol Co. Brown & Root Inc. Buell Engineering Co. Buffalo Forge Co	211 2666 303 92 489 373 219 63 76 405 351 415 6-57 389 69 5
Boston Woven Hose & Rubber Co. Bridgeport Brass Co. Bristol Co. Brown & Root Inc. Buell Engineering Co. Buffalo Forge Co	211 2666 303 92 489 373 219 63 76 405 351 415 6-57 389 69 5
Boston Woven Hose & Rubber Co. Bridgeport Brass Co. Bristol Co. Brown & Root Inc. Buell Engineering Co. Buffalo Forge Co	211 2666 303 92 489 373 219 63 76 405 351 415 6-57 389 69 5
Boston Woven Hose & Rubber Co. Bridgeport Brass Co. Bristol Co. Brown & Root Inc. Buell Engineering Co. Buflovak Enpt. Div. of Blaw-Knox Builders—Providence Inc. Butler Mfg. Co. Byron Jackson Co.  Cambridge Wire Cloth Co. Cambridge Wire Cloth Co. Carbide & Carbon Chemicals Corp. Carbolov Carpenter Steel Co. Carrier Corp. Cash Co. A. W. Century Electric Co. Chapman Valve Mfg. Co. Chase Brass & Copper Chemical Construction Co. Inc. Chemical & Power Products Inc. R Chemisteel Constr. Co. Inc.	211 2666 303 92 489 373 219 63 76 405 351 415 6-57 389 69 5
Boston Woven Hose & Rubber Co. Bridgeport Brass Co. Bristol Co. Brown & Root Inc. Buell Engineering Co. Buflovak Enpt. Div. of Blaw-Knox Builders—Providence Inc. Butler Mfg. Co. Byron Jackson Co.  Cambridge Wire Cloth Co. Cambridge Wire Cloth Co. Carbide & Carbon Chemicals Corp. Carbolov Carpenter Steel Co. Carrier Corp. Cash Co. A. W. Century Electric Co. Chapman Valve Mfg. Co. Chase Brass & Copper Chemical Construction Co. Inc. Chemical & Power Products Inc. R Chemisteel Constr. Co. Inc.	21 266 303 92 489 373 76 405 351 415 6-57 -389 69 50 94 408 88 245 417 414 288 16 392 491 392 491 491 491 491 491 491 491 491
Boston Woven Hose & Rubber Co. Bridgeport Brass Co. Bristol Co. Brown & Root Inc. Buell Engineering Co. Buflovak Enpt. Div. of Blaw-Knox Builders—Providence Inc. Butler Mfg. Co. Byron Jackson Co.  Cambridge Wire Cloth Co. Cambridge Wire Cloth Co. Carbide & Carbon Chemicals Corp. Carbolov Carpenter Steel Co. Carrier Corp. Cash Co. A. W. Century Electric Co. Chapman Valve Mfg. Co. Chase Brass & Copper Chemical Construction Co. Inc. Chemical & Power Products Inc. R Chemisteel Constr. Co. Inc.	21 266 303 92 489 373 219 63 76 405 351 415 6-57 389 69 5 5 0-91 94 408 8 8 245 417 414 288 16 392 491 396 337 337 405 337 405 405 405 405 405 405 405 405 405 405
Boston Woven Hose & Rubber Co. Bridgeport Brass Co. Bristol Co. Brown & Root Inc. Buell Engineering Co. Buffalo Forge Co. Lambridge Wire Cloth Co. Lambridge Wire Cloth Co. Lambridge Wire Cloth Co. Lambridge Wire Cloth Co. Carbolov Garbolov	21 266 303 92 489 373 219 63 76 405 351 415 6-57 389 69 5 5 0-91 94 408 8 8 245 417 414 288 16 392 491 396 337 337 405 337 405 405 405 405 405 405 405 405 405 405
Boston Woven Hose & Rubber Co. Bridgeport Brass Co. Bristol Co. Brown & Root Inc. Buell Engineering Co. Buffalo Forge Co. Lambridge Wire Cloth Co. Lambridge Wire Cloth Co. Lambridge Wire Cloth Co. Lambridge Wire Cloth Co. Carbolov Garbolov	21266 3033 922489 373219 6337 6405 351415 6-57 .389 69 50 94 408 88 245 417 414 288 392 491 396 233 357 263
Boston Woven Hose & Rubber Co. Bridgeport Brass Co. Bristol Co. Brown & Root Inc. Buell Engineering Co. Buffalo Forge Co. Lambridge Wire Cloth Co. Lambridge Wire Cloth Co. Lambridge Wire Cloth Co. Lambridge Wire Cloth Co. Carbolov Garbolov	21266303392489373637665574156-573899550-911944888613396623333577263884
Boston Woven Hose & Rubber Co. Bridgeport Brass Co. Bristol Co. Brown & Root Inc. Buell Engineering Co. Buflovak Eopt. Div. of Blaw-Knox. Butler Mfg. Co. Butlovak Eopt. Div. of Blaw-Knox. Butler Mfg. Co. Butlovak Eopt. Div. of Blaw-Knox. Butler Mfg. Co. Storm Jackson Co. Cambron Jackson Co. Cambridge Wire Cloth Co. Cameron Iron Worls. Carbide & Carbon Chemicals Corp. Carbolov Carpenter Steel Co. Carrier Corp. Cash Co. A. W. Century Electric Co. Chapman Valve Mfg. Co. Chase Brass & Copper. Chemical Corp. Chemical Corp. Chemical Construction Co. Inc. Chemical Construction Co. Inc. Chicago Bridge & Iron. Chiksan Co. Clarage Fan Co. Cleaver Brooks Co. Cochrane Corp. R. D. Cole Mfg. Co. B. R. R. R. Cole Mfg. Co. B. R. R. Cole Mfg. Co. B. R. R. R. Cole Mfg. Co. B. R.	21 266 303 373 219 636 76 405 351 415 6-57 389 69 50 94 408 85 245 417 414 288 16 392 439 439 439 439 449 449 449 449
Boston Woven Hose & Rubber Co. Bridgeport Brass Co. Bristol Co. Brown & Root Inc. Buell Engineering Co. Buflovak Eopt. Div. of Blaw-Knox. Butler Mfg. Co. Butlovak Eopt. Div. of Blaw-Knox. Butler Mfg. Co. Butlovak Eopt. Div. of Blaw-Knox. Butler Mfg. Co. Storm Jackson Co. Cambron Jackson Co. Cambridge Wire Cloth Co. Cameron Iron Worls. Carbide & Carbon Chemicals Corp. Carbolov Carpenter Steel Co. Carrier Corp. Cash Co. A. W. Century Electric Co. Chapman Valve Mfg. Co. Chase Brass & Copper. Chemical Corp. Chemical Corp. Chemical Construction Co. Inc. Chemical Construction Co. Inc. Chicago Bridge & Iron. Chiksan Co. Clarage Fan Co. Cleaver Brooks Co. Cochrane Corp. R. D. Cole Mfg. Co. B. R. R. R. Cole Mfg. Co. B. R. R. Cole Mfg. Co. B. R. R. R. Cole Mfg. Co. B. R.	21266 3033 922489 373 219 636 405 351 415 6-57 .389 69 50 94 408 88 245 417 414 288 16 392 491 393 357 263 84 433 83 84 333 84 833 84 84 85 86 86 86 86 86 86 86 86 86 86 86 86 86
Boston Woven Hose & Rubber Co. Bridgeport Brass Co. Bristol Co. Brown & Root Inc. Buell Engineering Co. Buffalo Forge Co. Cambridge Wire Cloth Co. Cambridge Wire Cloth Co. Carbora Forge Co. Carbora Forge Co. Carbora Forge Co. Carbora Valve Mfg. Co. Chapman Valve Mfg. Co. Chase Brass & Copper Chemical Construction Co. Inc. Chemical Construction Co. Inc. Chemical Construction Co. Inc. Chemical Construction Co. Chemical Gonstruction Co. Chemical Forge Construction Co. Chemical Construction Co. Chemical Forge Construction Co. Chemical Construction Co. Chemical Forge Construction Co. Chemical Gonstruction Co. Chemical Construction Co. Chemical	21266 3033 92489 373219 63376 405351 4156 6-57 3899 69 50-91 94408 8245 417414 2888 16392 4913 3966 3357 26384 3924 49386 3924 49386 3924 49386 3924 49386 3924 49386 3924 49386 493
Boston Woven Hose & Rubber Co. Bridgeport Brass Co. Bristol Co. Brown & Root Inc. Buell Engineering Co. Buffalo Forge Co. Byron Jackson Co. So. Cambridge Wire Cloth Co. Cambridge Wire Cloth Co. Cambridge Wire Cloth Co. Carborous Forge Co. Carborous Forge Co. Carborous Forge Co. Carpenter Steel Co. Chapman Valve Mfg. Co. Chapman Valve Mfg. Co. Chapman Valve Mfg. Co. Chemical Construction Co. Inc. Chemical Construction Co. Inc. Chemical & Power Products Inc. R. Chemisteel Constr. Co. Inc. Chicago Bridge & Iron Chiksan Co. Clarage Fan Co. Cleaver Brooks Co. Cochrane Corp. R. D. Co'e Mfg. Co. Cooper Alloy Foundry Co. Corning Glass Works	21266 3033 922489 373 219 636 405 351 415 6-57 .389 69 50 94 408 88 245 417 414 288 16 392 491 393 357 263 84 433 83 84 333 84 833 84 84 85 86 86 86 86 86 86 86 86 86 86 86 86 86

Crane Co
ADVERTISING STAFF Sales Manager
Darco Dept. Atlas Powder Co. 204
Eastern Industries Inc. 358 Electro Chemical Engrg. & Mfg. Co. LB458 E'cetric Refractories & Abrasives Corp. B322 E'cetric Steel Fdry. 67 Elliott Co. 59, 82-83 Esso Standard Oil Co. 285
Fairbanks-Morse & Co.     28, 46, 321       Fairfield Eng. Co.     15       Fansteel Mat. Corp.     242       Farrell-Bitmingham Co. Inc.     96       Fenwal Inc.     426       Filtration Engineers, Inc.     418

 
 Filtration Engineers, Inc.
 418

 Filtros Inc.
 452

 Fisher Governor Co.
 71
 Flexonics Corp. 456
Fluor Corp. 437 Fluor Corp. 437
Food Technology Inc. LB507
Foote Bros. Gear & Machine Corp. 399 

Gardner-Denver Co. 470 Gas Atmospheres Inc. 189 General Amer. Transp. Corp 179, 257, 419 General Chem. & Dye.
Gas Atmospheres Inc
General Amer. Transp. Corp 179, 257, 419
General Chem. Div. Allied Chem. & Dye
General Electric Co 68, 80, 420-421
General Chem. Div. Allied Chem. & Dye Corp.   109
Globe Steel Tubes Co
Goodman Mfg. Co
The B. F. Goodrich Co
B. F. Goodrich Chemical Co
Could National Batteries Inc. 88
Goulds Pumps Inc
Graphite Metalizing CorpL379
Graver Tank & Mfg. Co
I W Greet Co. T344
Grinnell Co. Inc
Groen Mfg. CoT328
Groen Mfg. Co
Hammel Dahl Co
Hardinge Co. Inc
Harshaw Chemical Co
H. N. Hartwell & Son Inc
Haveg Corp
Havnes Stellite
Heinkeken Inc., W. P
Helicoid Gage, Div. Amer. Chain & Cable 206
Hercules Powder CoL490
Heyden Chemical Corp
Hills McCanna Co
Homestead Valve Mfg. Co 442
Hooker Electrochemical Co 429
Heyi & Patterson Inc. // Hills McCanna Co. 244 Homestead Valve Mfg. Co. 442 Hooker Electrochemical Co. 429 Howell Electric Motors Co. Inc. 42 Hudson Pulp & Paper Corp. B328, B350,
LB507
Illinois Electric Porcelain CoT330
Illinois Electric Porcelain Co
Illinois Electric Porcelain Co
Illinois Electric Porcelain Co. T330 Ind. Filter Pump Mfg. Co. 247 Industrial Process Engineers 433 Ingersoll-Rand 85 Land Step Contributor Co. 4314
Illinois Electric Porcelain Co. T330 Ind. Filter Pump Mfg. Co. 247 Industrial Process Engineers 433 Ingersoll-Rand 85 Inland Steel Container Co. 434 Int. Engre. Inc. 1118
Illinois Electric Porcelain Co.   T330   Ind. Filter Pump Mfg. Co.   247   Industrial Process Engineers   433   Ingersoll-Rand   85   Inland Steel Container Co.   434   Int. Engrg. Inc.   118   Int. Nickel Co.   436
Illinois Electric Porcelain Co.   T330     Ind. Filter Pump Mfg. Co.   247     Industrial Process Engineers   433     Ingersoll-Rand   85     Inland Steel Container Co.   434     Int. Engrg. Inc.   118     Int. Nickel Co.   436     International Paper Co.   261
Illinois Electric Porcelain Co.   T330   Ind. Filter Pump Mfg. Co.   247   Industrial Process Engineers   433   Ingersoll-Rand   85   Inland Steel Container Co.   434   Int. Engrg. Inc.   118   Int. Kickel Co.   436   International Paper Co.   261   International Salt Co.   445   International Salt Co.   445   LT. E. Crayit Breaker, Co.   10610.   T. E. Crayit Breaker, Co.   10610.   1
Ind. Filter Fump Nilg. Co. 247   Industrial Process Engineers   433   Ingersoll-Rand   85   Inland Steel Container Co. 434   Int. Engig. Inc. 118   Int. Nickel Co. 436   International Paper Co. 261   International Salt Co. 445   I. T. E. Circuit Breaker Co. 106-107
Ind. Filter Fump Nilg. Co. 247   Industrial Process Engineers   433   Ingersoll-Rand   85   Inland Steel Container Co. 434   Int. Engrg. Inc. 118   Int. Nickel Co. 436   International Paper Co. 261   International Salt Co. 445   I. T. E. Circuit Breaker Co. 106-107
Ind. Filter Fump Nilg. Co. 247   Industrial Process Engineers   433   Ingersoll-Rand   85   Inland Steel Container Co. 434   Int. Engrg. Inc. 118   Int. Nickel Co. 436   International Paper Co. 261   International Salt Co. 445   I. T. E. Circuit Breaker Co. 106-107
Ind. Filter Fump Nilg. Co. 247   Industrial Process Engineers   433   Ingersoll-Rand   85   Inland Steel Container Co. 434   Int. Engrg. Inc. 118   Int. Nickel Co. 436   International Paper Co. 261   International Salt Co. 445   I. T. E. Circuit Breaker Co. 106-107
Ind. Filter Fump Nilg. Co. 247   Industrial Process Engineers   433   Ingersoll-Rand   85   Inland Steel Container Co. 434   Int. Engrg. Inc. 1118   Int. Nickel Co. 436   International Paper Co. 260   International Paper Co. 445   I. T. E. Circuit Breaker Co. 106-107   Jefferson Chemical Co. 413   Jeffrey Mfg. Co. 37   Jelliff Mfg. 8338   Jenkins Brothers 273   Jensins Brothers 273   Jensins Brothers 273   Jerguson Gage & Valve Co. 1386   Jenkins Brothers 273   Jerguson Gage & Valve Co. 1380   Jenkins Brothers 273   Jerguson Gage & Valve Co. 1436   Jenkins Brothers   273   Jerguson Gage & Valve Co. 1436   Jenkins Brothers   273   Jerguson Gage & Valve Co. 1436   Jenkins Brothers   273   Jenkins Brothers   273
Ind. Filter Fump Nilg. Co. 247   Industrial Process Engineers   433   Ingersoll-Rand   85   Inland Steel Container Co. 434   Int. Engrg. Inc. 1118   Int. Nickel Co. 436   International Paper Co. 260   International Paper Co. 445   I. T. E. Circuit Breaker Co. 106-107   Jefferson Chemical Co. 413   Jeffrey Mfg. Co. 37   Jelliff Mfg. 8338   Jenkins Brothers 273   Jensins Brothers 273   Jensins Brothers 273   Jerguson Gage & Valve Co. 1386   Jenkins Brothers 273   Jerguson Gage & Valve Co. 1380   Jenkins Brothers 273   Jerguson Gage & Valve Co. 1436   Jenkins Brothers   273   Jerguson Gage & Valve Co. 1436   Jenkins Brothers   273   Jerguson Gage & Valve Co. 1436   Jenkins Brothers   273   Jenkins Brothers   273
Ind. Filter Fump Nilg. Co. 247   Industrial Process Engineers   433   Ingersoll-Rand   85   Inland Steel Container Co. 434   Int. Engrg. Inc. 1118   Int. Nickel Co. 436   International Paper Co. 260   International Paper Co. 445   I. T. E. Circuit Breaker Co. 106-107   Jefferson Chemical Co. 413   Jeffrey Mfg. Co. 37   Jelliff Mfg. 8338   Jenkins Brothers 273   Jensins Brothers 273   Jensins Brothers 273   Jerguson Gage & Valve Co. 1386   Jenkins Brothers 273   Jerguson Gage & Valve Co. 1380   Jenkins Brothers 273   Jerguson Gage & Valve Co. 1436   Jenkins Brothers   273   Jerguson Gage & Valve Co. 1436   Jenkins Brothers   273   Jerguson Gage & Valve Co. 1436   Jenkins Brothers   273   Jenkins Brothers   273
Ind. Filter Fump Nilg. Co. 247   Industrial Process Engineers   433   Ingersoll-Rand   85   Inland Steel Container Co. 434   Int. Engrg. Inc. 1118   Int. Nickel Co. 436   International Paper Co. 260   International Paper Co. 445   I. T. E. Circuit Breaker Co. 106-107   Jefferson Chemical Co. 413   Jeffrey Mfg. Co. 37   Jelliff Mfg. 8338   Jenkins Brothers 273   Jensins Brothers 273   Jensins Brothers 273   Jerguson Gage & Valve Co. 1386   Jenkins Brothers 273   Jerguson Gage & Valve Co. 1380   Jenkins Brothers 273   Jerguson Gage & Valve Co. 1436   Jenkins Brothers   273   Jerguson Gage & Valve Co. 1436   Jenkins Brothers   273   Jerguson Gage & Valve Co. 1436   Jenkins Brothers   273   Jenkins Brothers   273
Ind. Filter Fump Nilg. Co. 247   Industrial Process Engineers   433   Ingersoll-Rand   85   Inland Steel Container Co. 434   Int. Engrg. Inc. 1118   Int. Nickel Co. 436   International Paper Co. 260   International Paper Co. 445   I. T. E. Circuit Breaker Co. 106-107   Jefferson Chemical Co. 413   Jeffrey Mfg. Co. 37   Jelliff Mfg. 8338   Jenkins Brothers 273   Jensins Brothers 273   Jensins Brothers 273   Jerguson Gage & Valve Co. 1386   Jenkins Brothers 273   Jerguson Gage & Valve Co. 1380   Jenkins Brothers 273   Jerguson Gage & Valve Co. 1436   Jenkins Brothers   273   Jerguson Gage & Valve Co. 1436   Jenkins Brothers   273   Jerguson Gage & Valve Co. 1436   Jenkins Brothers   273   Jenkins Brothers   273
Ind. Filter Fump Nilg. Co. 247   Industrial Process Engineers   433   Ingersoll-Rand   85   Inland Steel Container Co. 434   Int. Engrg. Inc. 1118   Int. Nickel Co. 436   International Paper Co. 260   International Paper Co. 445   I. T. E. Circuit Breaker Co. 106-107   Jefferson Chemical Co. 413   Jeffrey Mfg. Co. 37   Jelliff Mfg. 8338   Jenkins Brothers 273   Jensins Brothers 273   Jensins Brothers 273   Jerguson Gage & Valve Co. 1386   Jenkins Brothers 273   Jerguson Gage & Valve Co. 1380   Jenkins Brothers 273   Jerguson Gage & Valve Co. 1436   Jenkins Brothers   273   Jerguson Gage & Valve Co. 1436   Jenkins Brothers   273   Jerguson Gage & Valve Co. 1436   Jenkins Brothers   273   Jenkins Brothers   273
Ind. Filter Fump Nilg. Co. 247   Industrial Process Engineers   433   Ingersoll-Rand   85   Inland Steel Container Co. 434   Int. Engrg. Inc. 1118   Int. Nickel Co. 436   International Paper Co. 260   International Paper Co. 445   I. T. E. Circuit Breaker Co. 106-107   Jefferson Chemical Co. 413   Jeffrey Mfg. Co. 37   Jelliff Mfg. 8338   Jenkins Brothers 273   Jensins Brothers 273   Jensins Brothers 273   Jerguson Gage & Valve Co. 1386   Jenkins Brothers 273   Jerguson Gage & Valve Co. 1380   Jenkins Brothers 273   Jerguson Gage & Valve Co. 1436   Jenkins Brothers   273   Jerguson Gage & Valve Co. 1436   Jenkins Brothers   273   Jerguson Gage & Valve Co. 1436   Jenkins Brothers   273   Jenkins Brothers   273
Ind. Filter Fump Nilg. Co. 247   Industrial Process Engineers   433   Ingersoll-Rand   85   Inland Steel Container Co. 434   Int. Engrg. Inc. 1118   Int. Nickel Co. 436   International Paper Co. 260   International Paper Co. 445   I. T. E. Circuit Breaker Co. 106-107   Jefferson Chemical Co. 413   Jeffrey Mfg. Co. 37   Jelliff Mfg. 8338   Jenkins Brothers 273   Jensins Brothers 273   Jensins Brothers 273   Jerguson Gage & Valve Co. 1386   Jenkins Brothers 273   Jerguson Gage & Valve Co. 1380   Jenkins Brothers 273   Jerguson Gage & Valve Co. 1436   Jenkins Brothers   273   Jerguson Gage & Valve Co. 1436   Jenkins Brothers   273   Jerguson Gage & Valve Co. 1436   Jenkins Brothers   273   Jenkins Brothers   273
Ind. Filter Fump Nilg. Co. 247   Industrial Process Engineers   433   Ingersoll-Rand   85   Inland Steel Container Co. 434   Int. Engrg. Inc. 1118   Int. Nickel Co. 436   International Paper Co. 260   International Paper Co. 445   I. T. E. Circuit Breaker Co. 106-107   Jefferson Chemical Co. 413   Jeffrey Mfg. Co. 37   Jelliff Mfg. 8338   Jenkins Brothers 273   Jensins Brothers 273   Jensins Brothers 273   Jerguson Gage & Valve Co. 1386   Jenkins Brothers 273   Jerguson Gage & Valve Co. 1380   Jenkins Brothers 273   Jerguson Gage & Valve Co. 1436   Jenkins Brothers   273   Jerguson Gage & Valve Co. 1436   Jenkins Brothers   273   Jerguson Gage & Valve Co. 1436   Jenkins Brothers   273   Jenkins Brothers   273
Ind. Filter Fump Nilg. Co. 247   Industrial Process Engineers   433   Ingersoll-Rand   85   Inland Steel Container Co. 434   Int. Engrg. Inc. 1118   Int. Nickel Co. 436   International Paper Co. 260   International Paper Co. 445   I. T. E. Circuit Breaker Co. 106-107   Jefferson Chemical Co. 413   Jeffrey Mfg. Co. 37   Jelliff Mfg. 8338   Jenkins Brothers 273   Jensins Brothers 273   Jensins Brothers 273   Jerguson Gage & Valve Co. 1386   Jenkins Brothers 273   Jerguson Gage & Valve Co. 1380   Jenkins Brothers 273   Jerguson Gage & Valve Co. 1436   Jenkins Brothers   273   Jerguson Gage & Valve Co. 1436   Jenkins Brothers   273   Jerguson Gage & Valve Co. 1436   Jenkins Brothers   273   Jenkins Brothers   273
Ind. Filter Fump Nilg. Co. 247   Industrial Process Engineers   433   Ingersoll-Rand   85   Inland Steel Container Co. 434   Int. Engrg. Inc. 1118   Int. Nickel Co. 436   International Paper Co. 260   International Paper Co. 445   I. T. E. Circuit Breaker Co. 106-107   Jefferson Chemical Co. 413   Jeffrey Mfg. Co. 37   Jelliff Mfg. 8338   Jenkins Brothers 273   Jensins Brothers 273   Jensins Brothers 273   Jerguson Gage & Valve Co. 1386   Jenkins Brothers 273   Jerguson Gage & Valve Co. 1380   Jenkins Brothers 273   Jerguson Gage & Valve Co. 1436   Jenkins Brothers   273   Jerguson Gage & Valve Co. 1436   Jenkins Brothers   273   Jerguson Gage & Valve Co. 1436   Jenkins Brothers   273   Jenkins Brothers   273
Ind. Filter Fump Nilg. Co. 247   Industrial Process Engineers   433   Ingersoll-Rand   85   Inland Steel Container Co. 434   Int. Engrg. Inc. 1118   Int. Nickel Co. 436   International Paper Co. 260   International Paper Co. 445   I. T. E. Circuit Breaker Co. 106-107   Jefferson Chemical Co. 413   Jeffrey Mfg. Co. 37   Jelliff Mfg. 8338   Jenkins Brothers 273   Jensins Brothers 273   Jensins Brothers 273   Jerguson Gage & Valve Co. 1386   Jenkins Brothers 273   Jerguson Gage & Valve Co. 1380   Jenkins Brothers 273   Jerguson Gage & Valve Co. 1436   Jenkins Brothers   273   Jerguson Gage & Valve Co. 1436   Jenkins Brothers   273   Jerguson Gage & Valve Co. 1436   Jenkins Brothers   273   Jenkins Brothers   273
Ind. Filter Fulm Nilg. Co. 271
Ind. Filter Fump Nilg. Co. 247   Industrial Process Engineers   433   Ingersoll-Rand   85   Inland Steel Container Co. 434   Int. Engrg. Inc. 1118   Int. Nickel Co. 436   International Paper Co. 260   International Paper Co. 445   I. T. E. Circuit Breaker Co. 106-107   Jefferson Chemical Co. 413   Jeffrey Mfg. Co. 37   Jelliff Mfg. 8338   Jenkins Brothers 273   Jensins Brothers 273   Jensins Brothers 273   Jerguson Gage & Valve Co. 1386   Jenkins Brothers 273   Jerguson Gage & Valve Co. 1380   Jenkins Brothers 273   Jerguson Gage & Valve Co. 1436   Jenkins Brothers   273   Jerguson Gage & Valve Co. 1436   Jenkins Brothers   273   Jerguson Gage & Valve Co. 1436   Jenkins Brothers   273   Jenkins Brothers   273

Leeds & Northrup.	Prufcoat Labs Inc	Virginia Smelting Co. R. R382 Visking Corp
Mitchell & Co. IncT334	Sharples Corp	Yarnall Waring Co
Mixing Equipment Co. Inc	Shriver & Co. T	Youngstown Welding & Engineering Co. 260
Monsanto Chemical Co40-41	Sier-Bath Gear & Pump Co. Inc	Professional Services 492
Morris Machine Works	Sivver Steel Casting Co 34	SEARCHLIGHT SECTION
Mt. Vernon Woodberry Mills, Turner Halsey Co	The W. W. Sly Mfg. Co	(Classified Advertising)
Mundet Cork CorpT338	Smith, A. O	H. E. Hilty, Mgr. EMPLOYMENT
D. J. Murray Mfg. Co 457	Solvay Process Div. Allied Chem. & Dye	Positions Vacant 402 404
Nash Engrg. Co	Corp. 87	Positions Wanted 494
National Carbon Co	Sparkler Mfg	Selling Opportunities Offered. 493 Positions Wanted 494 Selling Opportunities Wanted 494 Employment Services 494
National Filter Media Corp 310	Special Screw Products Co	BUSINESS OPPORTUNITIES
National Foam System Inc	Spraying Systems Co	Offered
Neptune Meter Co	Sperry & Co., D. R	PROPERTY For Sale
Neptune Pump Mfg. Co	Sprout Waldron Co	EQUIPMENT
Newark Wire Cloth Co	Standard Oil Co	(Used or Surplus New) For Sale494-503
Niagara Alkali Co.         372           Niagara Blower Co.         L392	Standard Conveyor Co	WANTED
Nicholson Co., The	Wm. W. Stanley Co. IncLB447	Equipment
Nichols Engrg. & Research Corp L464 Nordstrom Valve, Div. Rockwell Mfg.	Stearns Magnetic Inc	Aaron Equipment Co 498
Co	Sterling Electric Motors	Amesco
Norton	Struthers Wells Corp 378	Bauer, L. W
Ohio Injector Co	Sturtevant Mills Co	American Air Compressor Corp.         496           Amesco         494           Barcan Co., Irving         496           Bauer, L. W.         503           Blumberg's Son Inc.         503           Brill Equipment Co.         497           Buflovak Equipment Co.         502           Carboloy, Dept. of General Elec. Co.         503           Chemical Service Corp.         494           Dalton Supply Co.         502           Dation Supply Co.         502           Drake Personnel Inc.         494           Eastern Metals Corp.         502           Electric Equipment Co.         500           Epstein, Perez         494
Oliver United Filters Inc 100	Sun Shipbuilding & Drydock Co 483 Surface Combustion Corp286, 318	Buflovak Equipment Co 502
Omega Machine Co	Superior Combusion Industries Inc LB466	Chemical Service Corp 494
Owens-Illinois Glass Co	Sutton Steele & Steele Inc	Dalton Supply Co
Pacific Pumps Inc	Swenson Evaporator Co	Drake Personnel Inc
Pangborn Corp	Taber Pump Co	Electric Equipment Co 500
Parker Appliance Co	Tank Car Div. Gen. Amer. Trans. Corp., 179	Epstein, Perez 494 Equipment Clearing House Inc. 496 Filtration Engineers Inc. 502
Peerless Mfg. Co	Taylor Forge & Pipe Works	First Machinery Corp. 500
Penberthy Injector Co 47	Taylor Instrument Co	First Machinery Corp. 500 Gale, C. J. 494 Gelb & Sons Inc. R. 499 Godfrey & Wing Inc. 494 Harber Ledwettele 500
Penfield Mfg. CoB335	Texas Gulf Sulphur Co 73	Godfrey & Wing Inc
Penn. Flex. Tubing         471           Penn. Salt Mfg. Co.         239	H. I. Thompson Co. The	Godfrey & Wing Inc. 494 Harber Industrials 502 Heat & Power Co., Inc. 498 Heinekein Inc., W. P. 496 Kéhoe Machinery Corp. 498 Lawler Machinery Corp. 496 Loeb Equipment Supply Co. 562
Permutit Co	Titeflex Inc	Kehoe Machinery Corp 498
Petro-Chem. Development Co. Inc L387	Tolhurst Centrifugal Div. Amer. Machine	Lawler Machinery Corp
Pfaudler Co	& Metals	Luria Steel & Trading Corp. Erman.
Phila. Gear Works 253	Traylor-Engrg. & Mfg. Co.         50           Trent Tube Co.         398	Howell Division
Phila. Quartz Co	Tri-Clover Machine Co116-117	Machinery & Equipment Co. (Can). 563 Machinery & Equipment Co. (NYC) 498
Pitts. Agricultural Chem. Co., Div. of Pitts. Coke & Chem. Co	Tube Turns Inc	Myer 1890 Bottling Co. Inc. 503
Pitts. Corning Corp 425	berry Mills	
Pitts. Lectromelt Furnace Corp 403	Uehling Instrument CoRT458	Perry Equipment Corp 501
Pitts. Lectrodryer Corp.         465           Powell Co., Wm.         26, 313	Union Bag & Paper Co 367	Roberts & Schaefer Co. 502 Sohl Manufacturing Co. 502
Powers Regulator Co	Union Carbide & Carbon Corp 5	Sohl Manufacturing Co. 502 South Daketa School of Mines & 492 Stanhope, J. M. 493 Stanhope, J. M. 500 Stein Equipment Co. 500 Strickler & Assoc. Dean C. 502 Superior Equipment Co. 488 Truland Chemical & Engineering Co. 494 Linion Standard Equipment Co. 498
Prater Pulverizer Co	U. S. Gasket	Stanhope, L. M
Pressed Steel Co.         192           Pressed Steel Tank Co.         473	U. S. Steel Co274-275	Stein Equipment Co
Process Controls Div. of Baird Associates 224	U. S. Stoneware Co 102	Superior Equipment Co
Proctor & Schwartz, Inc 343	Vapor Recovery Systems	Truland Chemical & Engineering Co 494 Union Standard Equipment Co 496
Proportioneers, Inc	Viking Pump CoB332	Vulcan Detinning Co., The 502
Current Eventenne Sentember	1052	£11

### INDEX OF ADVERTISED PRODUCTS

You can get, free, more information about any of the following advertisements.

Note: Mail the postcard inside the back cover to us. Answers will come direct to you from the companies. There is a page number on the postcard for each advertisement. Here's what the letters mean: L, R, T, B, (left, right, top, bottom) locating the ad on the page; small letters following, (a, b, c) indicate additional products in the advertisement. On the card, circle the page numbers of any items, below, about which you want more details.

Acid-proffing service
Air circuit breaker equipment, low-
voltage, bulletin GEC-849
Air conditioning equipment
Controlled humidity L39: Fans, cooling
Ceneral line
General line
Air handling equipment
Air handling equipment Blowers & exhausters, rotary
Blowers, axial flow31
Exhaustees
Exhausters, gas, centrifugal298
Fans & blowers, industrial201
Apparel industrial orlan PP456
Ratteries industrial
Reakers & note stainless steel RI 440
Bearings oilless L379
Bearings, oilless
Belts
Conveyors, rotocure
Conveyor, rubber coal handling 482
V, grommet
V, link448
V, grommet
bulletin TR-515300-30ly
storge and applications 445
Ruildings steel 415
Burners, gas
Carbon, activated
bulletin TR-515
Castings
Metal, testing facilities
Steel34
Steel and alloy steel
Centrifugals72, 190, 212, 1340
Alkali analysis, bulletin 9
Alumina 383
Aroclors as heat-transfer medium.
bulletin P-13040-41
Aroclors in maintenance paint, bulletin P-124
bulletin P-12440-41:
Aroclors in pliolite S-5 and marton
9200, bulletin P-12640-41h
Beta-resorcylic acid
bulletin 12 970
Calcium chloride 87
bulletin 12
Carbonate of Potash 3772 Caustic, mercury cell 337 Caustic soda 429 Caustic soda, bulletin 6 87b Chlorine bleach solutions, bulletin
Caustic, mercury cell337
Caustic soda429
Caustic soda, bulletin 687b
Chlorine bleach solutions, bulletin
1487h
14
Cool tor
Deformers
Antifoam AR387a
Antifoam A emulsion R387b
Di calcium phosphate 40-41e
Di calcium phosphate40-41e Ethylene oxide & propylent oxide.60-61
Fine, general line203

Furfurnal, bulletin 204248
General line
General line
industrial
Inorganic & organic
Milmer 1, paint mildew-proofing 40-41c
N-butyl acetate 5b N-butyl alcohol 5a Ozone 391 Penta, wood protecting 40-41d
Ozone 391
Penta, wood protecting 40-41d
Plant nutrients, water-soluble 40-41f
Plasticizer HR-40 bul P-104 41-41a
Propulene carbonate 412
Polybutenes 432 Propylene carbonate 413 Santicizer 8, for turning textile
scraps into plastics
Silicates of soda
Soda ash, bulletin 587a
Sodium hydrosulphite
Sodium thiosulfate, anhydrous 109
Solvents, petroleum285
Solvents, petroleum285 Sorbitol416
Thiourea
Clad steels
Clarifiers
Automatic continuous solid discharge
DG-2 autojecter485d
Continuous solids discharge, DH-2
DG-2 autojecter
solids, discharge, DV-2485e
General nurnose super centrifuge 485a
High capacity, DD-2, centrifuge . 485b Closures, drum, tri-sure
Closures, drum, tri-sure62
Clutches Friction
Friction
Coatings protective
Bitumastic446
Primer P-50
Bitumastic         446           Primer P-50         292           Rubber-base paints         455           Compressors         85           Compressors, single-stage         470
Compressors, single-stage
Bags & bag closing machines 261
Bags, multi-wall, 272, B328, 367, L1507
Bags & bag closing machines
Conveyors
Bulk materials, bulletin 39 55
Bulletin 308
Multi-tier
Pneumatic Airslide506b
Airveyor 506c
Airveyor
Fuller-Fluxo 506d
Fuller-Kinyon 506a Screw
Screw11
Shaker
Steel
bulletin 35215

Coolers	
Rotary	50
Water evaporator	11
Coolers Rotary Water evaporator Cooling tunnels Goverings & linings, rubber. 24 Diaphragms, electrolytic, filtros 35 R4 Diatomaceous products 2 Disintegration equipment	70
Diaphragms, electrolytic, filtros 35, R4	52
Diatomaceous products	21
Disintegration equipment	
Conical mills	
Dry grinding, bulletin 17-B-1126 Wet grinding, bulletin AH-398-11	8b
Wet grinding, bulletin AH-398-11	0.
Crushers	70
Crushers, rotary fine	75
Crushers, sawtooth 2	50
Cylindrical mills, bulletin AH-389-11	
26	81
Hammer-mills	0
Heliv cool	01
Pulverizers 37b TR 50	08
Hammer-mills Heavy duty	UG
model GSS. T3	35
Rod mills, bulletin 25-B-11 268	8d
Roll mills, high speed	04
Roller mills with air separation38	8c
Shredders	7c
Tricone mills, bulletin AH-414-11.26	8c
Shredders 3 Tricone mills, bulletin AH-414-11 26 Tube mills, bulletin 18-B-11 26	Se
Dryers Rulletin 508	47
Flash catalog 54.4	14
Cas with activated aluminas 4	65
Rotary 2	57
Rotary, hot air	42
Spray	64
Turbo	27
Dryers   Bulletin 508	)8
Dust collectors	
Cloth type, filter, bulletin 101L33 Multi-wash, bulletin 551 B33	23
Multi-wash, bulletin 551 B55	16
Suction filter 30 Tube type Dust control systems, type N, Roto-clone 22	58
Dust control systems type N	, 0
Roto-clone	25
Dust filters	58
Dust filters	53
Air, water or steam, bulletin 5124	7d
Air, water or steam, bulletin 512. 4. Steam jet	17
Engineering and Construction	17
Engineering and Construction Mercury cell process equipment Plants 2: Plants, "packaged" 4. Process plants 20 Process recovery systems, Wulff 4 Push button plants 744 Sulfur recovery plants 44	21
Plants	19
Plants, "packaged"	28
Process plants	37
Process recovery systems, Wulff 4	37
Push button plants	71
Sulfur recovery plants	19
Super phosphate process equipment	16
Evaporators	77
Fabricators	. /
Aluminum & stainless steel25	56
Conveyor dryer systems 34	13
Conveyor dryer systems	7d
Fermenters, stainless steel	31
Glassed steel equipment, bulletin	
894-H1	18
Heat exchangers	d
Heat exch. and pressure vessels39	13
Parts or assemblies, steel-weld 28	33
Piping	36
Pressure vessels41	11
Pressure vessels and process equipment	
of croloy-clad plate, bulletin S-14	
74-7	75

Process equipment	Heat transfer equipment, platecoils,	Processing, catalog 35640>
Process equipment, heat & corrosion-	bulletin P61	Kilns, rotary, bulletin A-442 488
resistant, sheet alloy192		Laboratory apparatus39b
Sheet metal	Ice-making equipment	Laboratory ware, platinum394
Stainless steel, chart 52D354		
		Linings
Stainless steel equipment266	Bubblers, sight feed	Rubber
Stainless steel, lead, wood, steel25		Tank, saran rubberL380
Storage vessels329		Lubricants
Tube, finned		Greases, stanobar51b
Tubes, Horton stainless steel 396	Automatic	Industrial lubrication service51a
Fabrics, non-woven, for product	Electric	Industrial oil, stanway51c
containers		Magnets, rectangular407
Fastenings, non-corrosive	Indicating	Material handling equipment
Feeders	Pneumatic	Loaders, tracto-shovel353a
Chemical	Pressure	Transfer industrial school 2521
		Tractors, industrial wheel353b
Chem., solution, dry materials TR466	Temperature, an-operated254c	Materials of construction
Flat pan		Alloy bar stock70
Tubular		Asbestos corrugated transite460
Feeder-weigher	operating	Carboloy chrome carbide, grade
Self-checking, large tonnage,	Temperature or pressure, steam	60890-91
bulletin 2140-2	operated234b	Cement, corrosion-proof, Furan 239
Self-contained, belt feeding,	Control systems, 3-part, plug-in 98-99	Cement, corrosion resistant,
bulletin 1549	Desuperheaters	bulletin 5-2290
Fibers, acrylic, orlon	Determinators	Clad steels450
Filter cloth	Carbon	Cooper and its alloys
Filter cloth, nylon	Sulfur	
	Draft	Fiberglas, resin bonded288
Filter fabrics		Hardness conversion tables,
Filter presses	Electrometer	bulletin TDC-125300-301w
Filter tubes, por., seamless, Alundum. 459	Flow & pH meters for waste disposal.22	Nickle alloy, for condensers436
Filters	Flow meters	Plastic7
General line, research & development9	Electrical481a	Plastic
Horizontal plate184-185	Ring balance325	Boltaron 62006
Pilot plant, stainless steel, string	Function plotter	Fiberglas-reinforced
or scraper discharge418	Gages	Teflon, for molded formsT322
Precoat and panel	Helicoid, chemical206	Uscolite
Pressure247a	HydrostaticTR458b	
Filtration & insulation material,		Stainless steel
	Liquid level, reflex, catalog 3547a	Croloy, for tubes & pipes,
refrasil	Liquid level, transparent,	bulletin TDC-148300-301
Fire extinguishers	catalog 35	For conveyors274-275
Air foam	Tank	For "photo-silver" process
Dry chemical, wheeled202	Welding padR380	equipment289
Carbon dioxide, low pressure472	Hopper level switchesR404e	Steel
Fittings	Indicators, multi-point481g	Chrome stainless, type 430120
Aluminum, "Triple-Lab"361	Indicators, precision78-79a	Stainless & special purpose 281
Corrosion-resistant, stainless	Liquid level	Turan 102
steel	Liquid meters	Tygon
Double-seal BR462	Manometers	Mineral fillers, celite201
Elbows, bronze walseal	U-typeL466a	Molding machines, tube-type 406
		Motor control center, bulletin
Fume duct, haveg249b	Well-typeL466b	GEA-4989.A
General line35	pH meters259	Motor controls, life-line32-33h
Joints, swivel, ball-bearing233	Plant stream analyzers224	
Stainless and high alloy67	Pneumatic processing systems 351	Motor starters, in water tight encl370
Stainless steel, bulletin Q100 31	Pressure controls, differential,	Motors
Tube360	bulletin CA-6DPTL449	Chem., life-line, booklet B-4687.18-19
Union and tee, bronze, walseal 293e	Recorders & controllers451	Explosion-proof42, 245
Welding	Recorders	Explosion proof, tube-type, bulletin
Welding, alloy374	Circular chart	51B714923
Welding, elbows	Duplex	Gear, life-line32-33a
	Electronic, continuous balancing,	
Fluid drives, gyrol		General line517
Furnaces, laboratory, catalog 104403	catalog P 1245373	Prelubricated, bulletin B-437852
Gaskets	Graphic panel, with full scale	Protected, open229
Pressure, seal joint441	chart112-113	Splash-proof, outdoor
Teflon, chemiseal	Multiple481h	Mixing & agitating equipment 433a
Gilsonite	Regulators, pressure, draft, flow, etc. 481i	
'Generators	Relays, auxiliary	Mixing equipment
Atmosphere, bulletin I-552 189	Rotameter, bulletin 18-RA 371	Agitators, booklet 58W378
Inert gas	Temperature controls, electric	Blenders, intimate
Steam	indicating, bulletin 1025 & 108029	Dissolvers
Steam, catalog 322 RB466		Mixers
	Temperature regulator, safety-type.	
Heaters	catalog RC-A424	Fluid, lightin'183
Direct, liquid L387b	Thermal controls, catalog 400426	Fluid, side entering358b
Direct, vaporL387a	Thermistors	Fluid, top entering358a
Gas cracking L387f	Thermometers481e	Fluid, turbine358c
Indirect, dowtherm L387c	Transmitters, pneumatic481b	Muller type, corrosion-resistant . 64-65c
Industrial radiant 200		
Industrial, radiant395	Insulation	Muller-type, elect. heated64-65d
Unit20c	Cellular glass425	Muller type, hot oil circulation . 64-65f
Unit, blast coils457	Heat, "Kaylo"223	Muller type, laboratory64-65a
Unit, blower-type400	Pipe & block, 85% magnesiaT338	Muller type, water-cooled 64-65e
Heat exchangers	Kettles	Slurry
Extended-surface352	Corrosion-resistant	VerticalL444
General line		
	General line433e	Nozzles
Graphite423	Mixers, stainless steelT328	Spray

Spray, industrial, catalog 22TR462a	K-405	bulletin TA-1559300-301
Spray, pneumatic atomizingTR462b	Refrigerating machines, reciprocating408	Stainless croloy, bulletin 1B-19
Packaging materials	Refrigeration equipment476	300-301
Kimpack36	Refrigeration equipment	Weight tables, bul. TB-15.300-3031
Polyethylene, visqueen362-363	Turbo453a	Welded steel26
Packings & gaskets, teflonR392	Vacuum, catalog H62443	Tubular products
Packings, flexible metallicT342	Rings, C-V teflon412	Application data, bulletin TB-344
Packings, tower, saddles, data	Safety equipment	300-301
sheet 13B	Gas masks, style WUG270a	Specifications, bulletin TB-11300-301
Pipe & fittings, impervious graphite	Respirators, chemical cartridge270b	Turbines
Karbate catalog section S-7000 277	Respirators, dust filtering270c	Gear, close-coupled, type E
Pipe & tubing, seamless croloy	Respirators, R200012	Book B-434625
12 Al, for pressure & mechanical	Safety heads, relief valve model CL-3114	Steam
uses, bulletin TDC-140300-301h	Scales	Steam, bulletins S-116 and S-146480
16-13-3, for pressure & mechanical	Bench dial321	VerticalB34
uses, bulletin TDC-133300-301f	Dust-tight, all elect., bulletin 3649.467a	Valves
18-18cb, for pressure and mechanical	Dust-tight, heavy-duty, bulletin	Angle & Y-globe, small cast steel 2931
uses, bulletin TDC-132300-301e	8946467b	Back pressure, bulletin 95686
25-20, for pressure & mechanical	Feeder, for screw, belt of vibrating	Bronze, extra-tough384
uses, bulletin TDC-134300-301g	feeder, bulletin 1449467c	Bronze, iron & steel, general line2/:
Tubing 18-8S for pressure & mech-	Screens, vibrating	Chainwell479
anical uses, bulletin TDC-130	Seals, pressure, rotary shaftL462	Control
300-301d	Separators	Limitorque25
Pipe	Centrifugals309	Lubricated-seal375-376
Glass, pyrex402	Continuous, bulletin C19314	Plug angle4
Haveg249a	General lineB334	Proportioning, series 700, bulletin
InsulatedL452	Gravity	700-3
Seamless or welded, stainless,	Service power, oil & chemical plant	With Domotor operator294
bulletin TB-332300-301c	experiences, bulletin TR-516300-301z	Corrosion-resisting, complete line26
Stainless steel	Shakers, sieve, testing	Diaphram, plastic or hard rubber175
Stainless steel	Speed dirves, variable, catalog CE81-G	Forged & cast steel205
Corrosion resistant	101	Gate
Schedule 594	Speed reducers, bulletin 44996	Cast iron213
Steel	Spray welding, hard-facing alloys284	Forged steel
Saran-lined	Steam traps, thermostatic, catalog	Forged steel, list 960417
Weights, specifications, etc.	751	Pressure-seal cast steel293a
bulletin TDC-138300-301r	Stoners, air-floatL404b	Stainless steel
Plates, stainless steel, solid or clad324	Strainers	Gland-type, bronze needle297
Power drives	Fluid397	Globe
Bulletin A-119430	Wire screen, monelB327	Bronze, walseal2930
Helical gearing399	Sulphur73	Corrosion resistant313e
Power generation equipment46	Superheaters, steam	Throttling, bronze313c
Power systems, high-voltage 420-421	TalcTL458	Heavy duty, all-iron181
Precipitators, electrostatic341	Tank cars179	Lead
Pressure vessels433b	Tanks, gas storageB308	Lift-plug, non-lubricated69
Processing systems	Tantalum242	Plug, cylindrical, catalog 4-CM95
Pulp & paper mill maintenance data,	Tools, hand and benchL385	Pressure reducing & regulating
bulletin TB-328300-301n	Transfer bus, switchgear38	bulletin 9668d
Pumcups, bulletin 4401228	Tube cleaners and expandersR464	Pressure reducing
Pumps	Tubes	Single seat, bulletin 9508b
Acid435	Alloy260	Type 1000, bulletin 9628a
Centrifugal	Boiler, corrosion data, bulletin	Regulating & pressure reducing. 481m
Bulletin 720.4243	514300-301x	Regulating, automatic, bulletin 350
Sanitary	Condenser, copper alloy10	487
Self-priming	Flexible metal471	Safety shut-off
Side-suction	Heat exchanger, aluminum381	Self-sealed, lubricated, Book No. 39.442
Chemical56-57	Heat exchanger, copper-base alloys,	Single seat, V-port356
Cycling jet, bulletin 503047c	bulletin 1950489	Solenoid
Process,	Heat exchanger and condenser,	
Heavy duty, refinery & chemical 469	bulletin TB-329300-301o	mounted
Open or closed impeller241	Stainless steel398	Type F, non-lubricated, bulletin
Proportioning	Steel	647279
Chemical	Water, copper414	
Pneumatic, bulletin 300226	Tubes & pipe,	Corrosion resistant313b
	Alloy, high-temperature steel,	Haveg
Type U, catalog UP-52244	bulletin TB-12300-301m	Vibrators, electric
Rotary	Stainless croloy, methods or working	Water conditioning equipment84
Rotary, bulletin LG48-49	bulletin TB-1300-301b	Water treatment
Screw	Tubing	Alkalies & chlorine in water
Slurry, type R235	Alloy seamless steel, for high tempera-	treatment, bulletin 887d
Steam-turbine driven, four-stage191		Compression stills263
Stuffing boxes287	ture & pressure, bul. TB-6300-3011	Demineralizers
Sump, explproof, bulletin 492947e	Alloy steel, chemical compositions,	
Turbine, bulletin 4700238	bulletin TDC-136300-301q	Mixed-bed, single tank30
Vacuum	Flexible seamless, bronze, bul. SS-50.86	Mono-column
Bulletin V-51B93	Stainless croloy 12 and 12-2300-301i	
Microvac	Stainless steel	Water analysis, bulletin 1187f
Vertical turbine	Stainless steel, for food processing	Weight control system, electronic467f Weighing system control panel467g
Raschig and partition ringsT330	bulletin TA-1517300-301k	Well water systems
Rectifiers, mechanical, bulletin 5106	Steel	Wire cloth, industrialL389
106-107	Descriptive bulletin TR-335 300-301v	Wire mesh products
100-107	- consperse principal 1 10-777, 700-7014	THE INCOME DIOGRAMS BSSS

-

## KEEPING UP with ideas in the news

You can get, free of charge, more information about any of the following items of new equipment, new products or new literature.

NOTE: The postcard inside the back cover makes ordering easy. Mail card to us; answers will come direct to you from the companies. On the card, circle the key numbers of any items, below, about which you want more details	trol. Clifford Mfg. Co
NEW EQUIPMENT	Consistometer—Measures consistency of viscous materials. Central Scientific Co
New Processing Equipment Distillation Travs—Grid type replace bubble caps, up tower	operations. Andrew Technical Service
output. Shell Development Co	Metal Hardness Tester—Operates on rebound principle, weighs 7 oz. Peabody Industries Inc
Twin Shell Blender-With rotating intensifier bar for im-	Battery Power Regulator-Facilitates operation of DU spec-
proved mixing. Patterson-Kelley Co	trophotometer. Beckman Instruments, Inc
ples. Specialized Instruments Corp 103	ing dial face. Marsh Instrument Co
Gyratory Screen—Gives better screening by rotating, gyrating motion. Nordberg Mfg. Co	New Fluids Handling Equipment
Pulverizer Mill-Hammer type now offered in larger sizes.	Leakproof Pump-Combines motor and impeller in one
Pulva Corp	housing. Chempump Corp
matically. Gustav Eirich	moid Co
Porous Metallic Cell-Acts as liquid and gas dispenser. Equi-	Centrifugal Pump-Double suction type with mechanical
poise Controls, Inc	seals. Ingersoll-Rand Co
lyzes multiple samples. Fisher Scientific Co 108	Westinghouse Electric Corp., Sturtevant Div 140
Filter Spray Jets—New type easily removable for cleaning. Hercules Filter Corp	Turbine Vane Pump—Delivers constant flow under varying head. Peerless Pump Div
Flash Point Tester-Electrically heated closed cup type. Pre-	Metering Pump-Operates at low rate against medium pres-
cision Scientific Co	sure. Proportioneers, Inc
Flask Agitator-Oscillating platform provides agitation and aeration. B. F. Gump Co	Centrifugal Compressor—Boosts gases in high pressure systems. Sawyer-Bailey Corp
Porous Filter Stones-Made in Germany and now offered by	Flow Regulator—Has been modified for greater accuracy.
U. S. distributor. Chemtech Products Corp 112	W. A. Kates Co
New Instruments & Controls	Okadee Co
Temperature Controller-Resistance bulb type, controls wide range. Thermo Electric Co., Inc	Pipe Coupling—New threadless connector for 2,000 psi.  Quik-Joint Mfg. Co
Strip Recorder-Has 30 day chart, six hour visibility. The	Acid Hose-Permits the handling of strong acids in rubber
Foxboro Co	hose. Hewitt-Robbins, Inc
Norcross Corp	Downflow Purifier—Cleans vapors entering process vessels.  The V. D. Anderson Co
Automatic Tank Gage—Measures contents of large tanks, has clear dial. The Vapor Recovery Systems Co	Industrial Fan—Can move air and solids up to 44,000 cfm.
Spectrophotometer-Has new attachment to increase sensi-	Westinghouse-Sturtevant Div
tivity. Beckman Instruments, Inc	American Hard Rubber Co
design. Weston Electrical Instrument Corp 118	Pipe Coupling Clamp—For heavy lines, speeds tanker unloading. Shell Petroleum Corp
Static Detector-Combines variable sensitivity, ease of use.	Plug Valve Gearing-Cone-Drive design now offered on
Keithley Instruments	larger size valves. American Car & Foundry Co 152
ments. Republic Flow Meters Co 120	Flexible Coupling—Combines Teflon bellows and standard flanges. United States Gasket Co
Temperature Regulator-Controls by hydraulic expansion. Farris Stacon Corp	Plastic Pipe and Coupling-Improved rigid pipe, new coup-
Water Vapor Indicator-Measures water vapor content of	ling up applications. Carlon Products
gases. American Instrument Co., Inc	with rolled plate. Grand Machine & Tool Co 155
man's, Inc	Pulsation Damper—Gives controlled slow flow of air, damps surges. King Engineering Corp
Flow Indicator—Generates proportional emf. for flow meas-	Sump Pump—Submersible type now has a cast iron water-
urement. Minneapolis-Honeywell Regulator 124 Refractometer—High speed unit designed for industrial use.	proof case. Kenco, Inc
Bausch & Lomb Optical Co 125	New Electrical & Mechanical Equipment
Contact Making Instrument—Provides both indication and control. Weston Electrical Instrument Co	Gear Motor-Now offered in 5 to 25 hp. range. Sterling Electric Motors, Inc
Air Velocity Meter-Uses sensitive thermopile, is accurate	Brake Motor-Has been built into line of transmissions.
within 2 percent. Hastings Instrument Co 127 Round Chart Recorder—Has been added to Dynamaster line.	Graham Transmissions, Inc
The Bristol Co	lines. Westinghouse Electric Corp

515

CHEMICAL ENGINEERING—September 1952

Air Transformer-Offers easy, close pressure regulation. The	Pressure-Sensitive Tape-Excels in heat and chemical resist-	212
DeVilbiss Co	ance. Minnesota Mining and Mfg. Co	
Clover Machine Co	and other plastics. Chemical Development Corp	213
Electric Fixtures—Explosion-proof design for flush mounting.  Crouse-Hinds Co	Hard Facing Electrode—Abrasion and shock resistant chrome, manganese, silicon, iron alloy. Wall Colmonoy Corp	
Bushing Extractor-Allows easy removal of bushings from	Wetting Agent-For use in the textile industries as a de-	
blind holes. Crozier Machine Tool Co	greaser for metal parts. Sharples Chemicals, Inc Two Latices—Of special interest to paper and textile con-	215
Safety Wiring—Has mineral insulation, metal sheathing. General Cable Corp	verters. Goodyear Tire & Rubber Co	216
Multi-Speed Transmission-Has four speeds, in sizes to 60	Soil Fungicide-Soon to be produced for control of soil path-	217
hp. Turner Machinery Co	ogens in tobacco seed beds. Julius Hyman & Co  Packaging Film—Tear-resistant, transparent, will not cling	21/
Farris Hydroseal Corp	or pucker. Goodyear Tire & Rubber Co	
Drainage Gutters—Come prefabricated, ready to install 168	Rubber-Base Paint-Resists moisture and alkali on outside	
Anchor Bolt Assemblies—Single and double type give 50 percent greater anchorage. Super-Grip Anchor Bolt Co 169	masonry. Tropical Paint & Oil Co	417
Inter-Lock Receptacle-Permits use of cord sets in hazardous	pounds now available here. Nuclear Instrument & Chem-	220
locations. Tigerman Engineering Co	ical Corp.	220
model. General Electric Co	NEW TECHNICAL LITERATURE	
Magnetic Pulleys-Lighter weight with 30 percent increase	Boiler Tubes—Top working pressures of electric resistance- welded steel tubes. 4 p. Babcock & Wilcox Co	301
in pulling power. Ericz Mfg. Co	Spectrophotometers-Detection limits of more than 20 met-	
and labor. Squire-Cogswell Co	als. Beckman Instruments, Inc.	302
Steam Jet Cleaner-Improved model JC-30 operates at higher pressures. Livingstone Engineering Co	Tonnage Oxygen—Linde-Fraenkl process and equipment. Photos. 24 p. Blaw-Knox Construction Co	303
Linear Ball Bearing—New large size for use on 2½ in. shafts.	Fittings-Specifications and prints on fittings for light-weight	
Thomson Industries, Inc	pipe. 4 p. Naylor Pipe Co	304
Knee Action Caster—In rated capacities from 50 to 1,500 lb. The All Steel Welded Truck Co		305
Pillow Blocks-New all steel construction with minimum	Pump Cups-For pump pistons, hydraulic service and pneu-	206
dimensions. Dodge Mfg. Corp	matic equipment. 6 p. Garlock Packing Co  Safety—Test data on resistance of Orlon clothes to acids and	306
Lubricant Gun—Designed for high pressure lubrication of valves. Lincoln Engineering Co	chemicals. 16 p. Worklon, Inc	307
Lubricant Pump-Portable type handles light and heavy	Protective Coatings—Describes a line of coatings and illustrates uses. 4 p. Spring Packing Corp	308
lubricants. Lincoln Engineering Co	Pumps-A quick survey of the pumps and other products	200
dustrial trucks. Gould-National Batteries, Inc 180	made by this company. 32 p. Worthington Corp	309
New Safety Equipment	Silicone Rubber-Review of properties and performance.  16 p. Dow Corning Corp	310
Radiation Monitor-Automatically checks hands and feet for	Pumps-Dimensions, photographs, diagrams of a line of cen-	
contamination. Nuclear Instrument & Chemical Corp 181 Safety Clamp-Holds cylindrical glassware safely and securely 182	trifugals. 34 p. Nagle Pumps, Inc	311
Bi-Colored Lens-Protects eyes against visible, ultraviolet and	160 p. Carbide and Carbon Chemicals Co	312
infrared radiations. American Optical Co 183	Insulation-Detailed list of recommended Class H compo-	212
New Packaging & Handling Equipment	nents. 4 p. Dow Corning Corp	313
Conveyor Belt-Gives more flexibility, puncture and tear	properties. 32 p. Dow Corning Corp	314
resistance. Manhattan Rubber Div	Process Equipment—Pictures a line of blowers and mixers.  12 p. Read Standard Corp	315
flow direction change. Lamson Corp	Dust Collectors-Construction, installation of a suction filter	
Lever Bolt Ring-For drum heads, combines lever locking, bolt closing. Drum Parts, Inc		316
Fork Truck Scoop-Mounts on standard truck, handles dry	Instruments—How X-ray techniques can help solve your ma- terials problems. 4 p. North American Philips Co	317
bulk material. The Elwell-Parker Electric Co 187	Instruments-Operating principles, uses of an X-ray tin coat-	
NEW PRODUCTS	ing gage. 8 p. North American Philips Co	318
Ceramic Fiber-For electrical insulation, chemical filters,	positioning system. 12 p. Farris Hydrotorque Corp	319
packing material. Carborundum Co	Paper Flotation-Process and equipment. Two bulletins, 4 p. ea. Denver Equipment Co	220
Refrigerant-Nonflowing, nonfuming ice or dry ice substi- tute. Chemical & Fibre Associates	Paint-Acid and alkali resistant for metal, wood or masonry.	240
Orthodichlorobenzene-New pure grade suitable for making	4 p. Speco, Inc	321
dyestuffs, intermediates. Solvay Process Div 203 Propyl Acetate—Economical replacement for solvents like	Pumps—For handling light refinery liquids at temperatures to 250 deg. F. 16 p. Ingersoll-Rand Co	322
MIBK. Celanese Corp. of America	Nickel-Its use in building up worn parts by electrode-posi-	
Chlorine Trifluoride—Easier handling but comparable to fluorine in properties. Pennsylvania Salt Mfg. Co 205	tion. 6 p. International Nickel Co	323
Oxychloride Cement-To form a tough, resilient lining for		324
freight cars. Westvaco Chemical Div	Tubing-Differences in production, surface finish, tolerances,	275
Kel-F-Increasing applications in the chemical processing field. M. W. Kellogg Co	cost. 4 p. Babcock & Wilcox Co	325
Insulating Resins-Electrical units imbedded in a solid block	sures. 16 p. Grove Regulator Co	326
get protection. Minnesota Mining and Mfg. Co 208  Resin-For chemical-resistant cement with higher tensile	Viscose Rayon Fabrics—Their properties when treated with a new chemical finish. 8 p. Dan River Mills, Inc	327
strength. Irvington Varnish and Insulator Co 209	Carbon Black-Lists blacks for the paint, ink, plastics and	
Hydrogen Peroxide—A grade specially developed for food processors. Buffalo Electro-Chemical Co	paper industry. 16 p. Godfrey L. Cabot, Inc 3 Vacuum Equipment—Pictures rotary and rotating vacuum	328
Enamel—Fast-drying, chemical resistant, high gloss finish for	dryers, vacuum shelf dryers. 12 p. F. J. Stokes Machine	
industrial equipment. Wilbur & Williams Co 211	Co	129

endless V-belts. Brammer Corp		36 p. Perkin-Elmer Corp	346
Switches—Illustrates high capacity switches for outdoor serv- ice. Delta-Star Electric Co	331	Rotary Dryer-For high moisture content materials like so- dium sulphate. 4 p. Standard Steel Corp	347
Dust Filter-Details of construction, principle and applica- tion. 8 p. W. W. Sly Mfg. Co		Welding—Picture of units for flame cutting, heating and welding. 16 p. Victor Equipment Co	348
Conduit—Flexible steel liner with plastic cover to protect electrical wiring. 2 p. Flexonics Corp		MotorsLarge wound-rotor and squirrel-cage polyphase in- duction motors. 6 p. Electrical Products Co	349
Metal Hose—Specifications for all purpose tubing and duct- ing. 4 p. Flexonics Corp		Dryers-Applications and operation of steam jacketed horizontal type. 4 p. Standard Steel Corp	
Phenolic Compounds-Chart gives properties and uses. 4 p.		Dibutyl Phthalate-Properties and uses in compounding. 1 p.	
Durez Plastics & Chemicals, Inc		Witco Chemical Co	
ion exchange. 8 p. Chemical Process Co		American Cyanamid Co	352
less types. 32 p. Flexonics Corp	337	success. 6 p. Harold F. Howard Co	353
cation. 2 p. Ess Instrument Co	338		354
tions. 4 p. Consolidated Engineering Corp	339	23 p. Hess Products Ltd	355
Instrument—Gives direct readings of both linear and tor- sional velocity and displacement. 4 p. Consolidated Engi-		Traps—Magnetic pipeline type for sanitary and standard appli- cations. 4 p. Eriez Mfg, Co	356
neering Corp.  Air Conditioning—Use of water in cooling towers and con-	340	Compressors—Radial air type produce 80 to 125 lb. pressure.  12 p. Worthington Corp	357
densers. 2 p. Water Service Laboratories  Peroxygen Chemicals—Potentialities in the field of seed treat-	341	Conveyors—Photos, drawings and specifications of a complete line. 28 p. Rapids-Standard Co	358
ments. 8 p. Buffalo Electro-Chemical Co	342	Valves-Dimensional data sheets on a line for fluid control.	
Sier-Bath Gear & Pump Co	343	Tachometer Heads—Heavy duty line to measure low rotational or linear speeds. 2 p. Metron Instrument Co	
Motor Controls—Speed-torque curves and typical applica- tions. 8 p. General Radio Co	344	Salt Bath Furnaces-How to up efficiency on 10 heat treat-	
Heating—Photos and drawings of direct-fired heating units.  8 p. Prat Daniel Corp		ing applications. 4 p. Ajax Electric Co Electronic Equipment—Specifications and photos of unit pro-	201

### USE THIS HANDY POSTCARD FOR MORE INFORMATION . . .

Circle numbers of desired items, fill in reverse side, tear out and mail

 		CHE	MICAL	EN	CINE	FRI	NC. S	Sond m	0.0	MEO	info	emati	on a	hout				
 Adve	rtiseme		these p						e n	nore	111101	maur	on a	bout				
2 4 5a 5b 67 8a 8b 8c 9 0 111 1213 145 167 18-19 20b 212 223 224 26	28 44 29 4 30 4 31 4 32-33a 4 33-33b 4 35 50 36 5 37a 5 37b 5 37c 5 38 54	5 70 70 71 72 72 72 73 78 78 78 78 78 78 78 78 78 78 78 78 78	79h 105 106-107 109 83 111 112-113 114-115 116-117 116-117 116-117	186 189 190 191 192 195 196 197 201 202 203 204 205 207 212 214 a 217 b c 221	234d 234e 234f 235 237 238 249 242 243 244 245 247a	259 260 261 262 263 265 265 268 2684 2684 2684 2684 270a 270b 270c 271 272	293b 293c 293d 293e 294 295 297 298a		309 310 311 312 313a 313a 313d 313d 315 316 317 318 319a 319a 321 T322 H322 H322 H322 T322 T322 T322	B332 333 T334 H334 T335 B335 337 T338 B338 T340 B340 341 T342 B342 T344 T344 T344 B344 345	B348 349 T350 B350 351 352 353b 353b 358b 358b 358c 358c 358c 362-363 365a 365a 365b 365b 367 369 4	375-374 377 L379 L379 L380 R381 L382 R382 R382 R382 R382 R382 R382 R382 R	5 R.390 391 1.392 R.392 R.394 395 397 398 399 401 402 403 1.404a R.404b R.404a R.404b R.404c R.405c R.404c	432	445 446 TL447	TR462b BR462 463 L464	469 470 471 472 473 475 476	
 Edito	rial iten	ns in t	this KEE	PING	UP s	ectio	on as c	ircled b	elow	:								
101 102 103 104 105 106 107 108 109 110	112 12 113 12 114 12 116 12 117 12 118 12 119 13 121 13 121 13	4 134 5 135 6 136 7 137 8 138 9 139 0 140	144 145 146 147 148 149 150 151	153 154 185 156 157 158 159 160 161 162	163 164 165 166 167 169 170 171 172	173 174 175 176 177 178 179 180 181 182	183 184 185 186 187 201 202 203 204 205	206 207 208 209 210 211 212 213 214 \$15	303	306 307 308 309 310 311 312 313 314 314	316 317 318 319 320 321 322 323 324 826	326 327 328 329 330 331 332 333 331 <b>335</b>	336 337 338 339 340 341 342 343 344 <b>34</b> 5	346 347 348 349 350 351 352 353 354 <b>355</b>	356 357 358 359 360 361 362 363 364 <b>365</b>	366 367 368 369 370 371 372 373 374 <b>875</b>	376 377 378 379 380 381 382 383 264 386	386 387 388 389 390 391 392 393 294 895
Card	Expire	Dece	mber 15															

viding voltage regulated power supply. 22 p. Kepco Lab oratorics, Inc.  Motors—Low speed right-angle worm-gear motor. Construction drawings. 8 p. U. S. Electrical Motors Inc.  Instruments—Circuit diagrams with component lists for contact meter relays. 21 p. Assembly Products Inc.  Silicone Rubber—Properties, applications, classes and design specifications. 24. p. General Electric Co.  Packaging—Comprehensive view-tof some proven ideas. 16 p. W. C. Ritchie and Co.  Motors—Construction and ventilation of outdoor splashproof induction type. 4 p. Elliott Co.  Motor Drives—Pictures upright and horizontal drives, closed or skeleton types. 16 p. Worthington Corp.  Resin Enulsion—For reinforcing and tackifying natural, synthetic rubber latex. American Resinous Chemicals Corp.  Organics—Lists this company's line, with uses and properties. 8 p. Shell Chemical Corp.  Heat Enclosures—Refractory arch development up to modern constructions. M. II. Detrick Co.  Dust Collectors—Cloth tube type for use in agricultural chemical field. American Wheelabrator & Equipment Corp.  Thermometers—Applications, chart ranges, dial ranges and accessories. Electric Auto-Lite Co.  Valve Servicing—Describes high-pressure portable lubricant pump. 2 p. Lincolu Engineering Co.  Purity Meter—For testing either distilled or demineralized water. 6 p. Barnstead Still & Sterilizer Co.  Hose—Specifications for 5 basic hose types. 8 p. Thermoid Co.	362 363 364 365 366 367 368	Pumps—Reference chart on small pump applications. 6 p. Tuthill Pump Co. Rod Packagings—General service recommendations and specifications. 8 p. Garlock Packing Co Instruments—Step-by-step explanation of units in pH control cycle. 16 p. Foxboro Co. Plasticizer—Properties and uses of a primary plasticizer for vinyl resins. 2 p. Witco Chemical Co Valves—Parts list, dimension table, installation of automatic shut-off type. 4 p. Security Valve Corp Corrosion Resistance—Equipment made of unplasticized polyvnyl chloride. 4 p. American Agile Corp Carbon Steel Tubing—Mechanical and physical properties, expanding, bending. 4 p. Babcock & Wilcox Co	386 381 382 383 384 385 386 387 388 389 390 391
Hose-Specifications for 5 basic hose types. 8 p. Thermoid		Carbon Steel Tubing-Mechanical and physical properties,	
Detergents-Properties and uses of two sodium alkyl aryl		Equipment-Covers a line including various types of feeders	
sulphonates. 24 p. Oronite Chemical Co	377	and vibrators. 52 p. Syntron Co	394
cations. 4 p. De Laval Steam Turbine Co	378	tion cells. 16 p. W. B. Connor Engineering Corp	395

### USE THIS HANDY POSTCARD TO HELP YOU IN KEEPING UP

(Directions on the other side)

PLACE 3¢ STAMP HERE

CHEMICAL ENGINEERING
READER SERVICE DEPARTMENT
330 W. 42nd STREET
NEW YORK 36, N. Y.

You can't beat the combination of the RIGHT horse-power, the RIGHT shaft speed, the RIGHT features all in one compact unit that you can use RIGHT where you want it. It's the best way and the easiest way to select your power drives because you purchase one unit, handle one unit in your receiving, production, and maintenance departments . . . set one unit in place and you're ready to go.

Master Motors, available in thousands and thousands of combinations of types and ratings, permit you to use a power drive that will add greatly to the compactness, appearance, and economy of each of your applications . . . a power drive that makes a good job better.

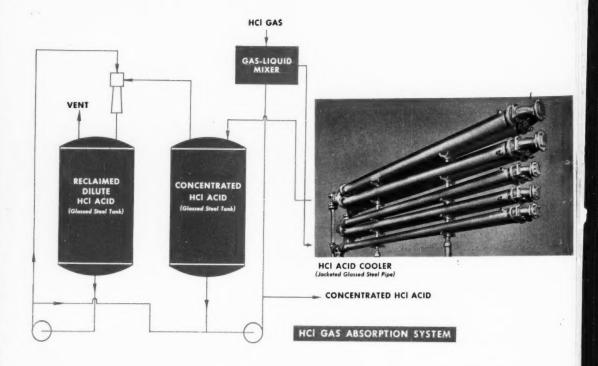
Use Master Motors to increase the salability of your motor driven products . . . improve the economy and productivity of your plant equipment. They're the horsesense way to use horsepower.

THE MASTER ELECTRIC COMPANY
DAYTON 1, OHIO

makes a good job better







## If you process with HCl, you need

# the corrosion resistance of glass plus the working strength of steel

For handling that most corrosive of all commonly used acids, hydrochloric, Pfaudler glassed steel is the most completely suitable material of construction available today.

Fully resistant to all concentrations of HCl at temperatures up to at least 300°F., glassed steel permits full-scale operation of many processes which otherwise might never move out of the laboratory. Even at temperatures approaching 400°F., glassed steel equipment is sufficiently resistant to HCl attack to provide satisfactory, though not unlimited, service life.

Other materials are, of course, also used for HCl, but for wide application all are limited either by size, pressure, temperature, impurities, fragility, or cost. Glassed steel knows no such limitations.

Pfaudler glassed steel pressure reactors, in capacities from 5 to 3500 gallons, are commonplace in chemical processing today. These units are equipped with agitation, are usually jacketed, and are supplemented by a complete line of glassed steel pipe, fittings and valves.

Custom-built vessels as large as 8300 gallons, for severe chemical service, have been constructed. Glassed steel columns and evaporators solve many serious corrosion problems.

To give it working strength, Pfaudler glass is fused to steel in huge furnaces at temperatures of 1500-1700 °F. This high-temperature firing locks the glass to the steel and makes it hard and tough.

Pfaudler glassed steel is resistant to all acids except hydrofluoric, even at elevated temperatures and pressures. With a new Pfaudler glass, it is possible to handle not only acids but also alkaline solutions up to a pH of 12 and 212°F. Thus, both acid reactions and neutralizations can be performed in the same glassed steel vessel.

Whenever you have an equipment problem requiring corrosion resistance, durability, and versatility, as well as the economy which these features provide, look to Pfaudler glassed steel for the solution.

Write for Bulletin 894-Hl, our new general catalog.

### PFAUDLER THE PFAUDLER CO., ROCHESTER 3, N. Y.

Engineers and fabricators of corrosion resistant process equipment since 1884

Factories at: Rochester, N. Y.; Elyria, Ohio; Leven, Fife, Scotland; Schwetzingen-Baden, Germany